

**COMMENT LETTERS REGARDING APRIL 30, 2004
PROPOSED BASIN PLAN AMENDMENT AND STAFF REPORT FOR MERCURY IN
SAN FRANCISCO BAY**
(in alphabetical order by organization)

Alameda Countywide Clean Water Program, Jim Scanlin

Allen Matkins (Buckhorn), David Cooke

Bay Area Clean Water Agencies, Don Birrer

Bay Area Stormwater Management Agencies Association, Don Freitas

Bay Planning Coalition, Ellen Johnck

California Department of Transportation, David Yam

Delta Diablo Sanitary District, Gary Darling

E^xponent (Santa Clara Valley Water District), Gary Bigham

Fairfield-Suisun Sanitary District, Larry Bahr

Fred Krieger (Individual)

LeBoeuf, Lamb, Greene, and MacRae (Sunnyvale), Robert Thompson

Livermore, City of, Darren Greenwood

Morrison and Foerster (SCVURPPP), Robert Falk

Mountain View Sanitary District, David Contreras

*Note: Comment letters for organizations that start with P Through W are in a separate PDF file.
-To access a specific comment letter easily, click on "Bookmarks" to the left.*



Alameda Countywide Clean Water Program

A Consortium of Local Agencies

951 Turner Court, Hayward CA 94545-2698
(510) 670-5543 FAX (510) 670-5262

June 14, 2004

Bill Johnson
Richard Looker
California Regional Water Quality Control Board,
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, CA 94612

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the Alameda
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SUBJECT: ACCWP COMMENTS ON MERCURY IN SAN FRANCISCO BAY
TMDL AND PROPOSED BASIN PLAN AMENDMENT

Dear Bill and Richard:

This letter is submitted on behalf of the Alameda Countywide Clean Water Program (ACCWP) in response the Regional Water Quality Control Board's April 30, 2004 notice of a public hearing on the subject documents.

As I am sure you would agree, the adoption of the mercury TMDL and associated Basin Plan amendment is a very significant action and will likely set precedent for other TMDLs and related Basin Plan amendments that the Regional Water Quality Control Board (Board) will adopt over the next several years. You have done an outstanding job in attempting to grapple with a very difficult issue. As you are well aware, mercury pollution in San Francisco Bay is a very difficult problem to deal with due to factors such as legacy sources, global atmospheric deposition, and methylation. Addressing this problem within the confines of the TMDL regulatory structure while maintaining technical and economic feasibility is at least a difficult and maybe even an impossible task. At least in relation to the allocation to urban runoff, this version of the TMDL project report and proposed Basin Plan amendment, while apparently meeting the requirements of the TMDL regulations, has failed to meet the standard of technical and economic feasibility.

As outlined in the comment letter submitted by BASMAA, the proposed 50% reduction cannot possibly be met by source control efforts alone. Extensive treatment systems would need to be constructed and operated at an estimated cost of several hundred million dollars per year. This is not a feasible approach. The TMDL report and proposed Basin Plan amendment should be revised to provide a reasonable allocation to urban runoff that is based upon estimates of reductions that could be achieved through various actions.

ACCWP supports and concurs with the comments submitted by BASMAA and hereby incorporates BASMAA's comments by reference. We have also attached our letter of July 22, 2003 that was submitted as informal comments on the draft mercury TMDL project report and hereby incorporate those comments by reference. Thank you for your

consideration of our comments. We appreciate Mr. Wolfe's offer to meet with interested parties and look forward to working with you to refine the proposed Basin Plan amendment.

Sincerely,

A handwritten signature in black ink that reads "James Scanlin". The signature is written in a cursive, flowing style.

James Scanlin
Program Manager

Enclosure: ACCWP comment letter dated 7-22-03

Copy: Bruce Wolfe, SFBRWQCB
Tom Mumley, SFBRWQCB
Dale Bowyer, SFBRWQCB
ACCWP Management Committee Representatives (via email)



Alameda Countywide Clean Water Program

A Consortium of Local Agencies

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July 22, 2003

Bill Johnson
Richard Looker
California Regional Water Quality Control Board,
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, CA 94612

Member
Agencies:

Alameda

Albany

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and Water
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Zone 7 of
the Alameda
County
Flood Control
District

**Re: Mercury in San Francisco Bay
Total Maximum Daily Load (TMDL) Project Report**

Dear Bill and Richard:

This letter is submitted on behalf of the Alameda Countywide Clean Water Program (ACCWP) in response to Tom Mumley's June 6th invitation to submit comments and feedback regarding the TMDL Project Report for Mercury in San Francisco Bay (Report).

I first want to commend the two of you, Tom Mumley, other involved Regional Board staff members, the Regional Monitoring Program, the San Francisco Estuary Institute and the Clean Estuary Partnership for all the work that has gone into finalization of this Report. Although we would like to have had more opportunity for input regarding some of the recent changes in the Project Report, we appreciate Board staff's facilitation of the stakeholder process throughout the various stages of Report development. We anticipate and request that this stakeholder process continue through the Basin Plan amendment preparation, adoption and implementation process.

We are mindful of that fact that mercury concentrations in San Francisco Bay fish are high enough to threaten human health and the sport fishing beneficial use of the Bay. In addition, mercury threatens wildlife and rare and endangered species. We recognize that mercury is a persistent, bio-accumulative, toxic metal that does not degrade in the environment. Consequently, we support reasonable efforts to address controllable water quality factors that cause detrimental mercury concentrations in sediment, aquatic organisms, wildlife and humans.

In addition to our support for the efforts necessary to address the controllable water quality factors, we have significant concerns relating to the Project Report as stated in this letter. These concerns are in the nature of constructive comments in anticipation of clarification and possible changes that may contribute to a more accurate and effective Project Report. It is our understanding that the Report and the responsive comments will form the basis of Basin Plan amendments to be acted upon by the Board later in the year. These concerns are in addition to the comments submitted by BASMAA, which we also support.

As you know, a great many scientific uncertainties and unknowns exist with respect to the measurements of source assessment, establishment of numeric targets, linkage between sources and targets, load allocations and effectiveness of implementation actions. In view of these uncertainties, we feel that it is of utmost importance that the goals and targets are flexible enough to allow for appropriate adjustment and modification as more scientific data becomes available and implementation experience develops. Stated differently, while dischargers can and should be held to implementation of various reasonable methods of controllable mercury reduction, numeric results of such methods and actions cannot be assured. We feel strongly that the process (including the implementing Basin Plan amendment) must be flexible enough to allow for such uncertainties and that the specific scenarios suggested in the BASMAA letter should be incorporated into the staff report.

The following comments are directed at three areas of particular concern: (1) uncertainties and unknowns regarding loads from urban stormwater and the relationship between proposed actions and load reductions; (2) the feasibility of some of the proposed implementation actions; and (3) the allocation places a disproportionate level of reduction for urban runoff programs.

(1) Uncertainties regarding loading and proposed reductions

The Report states that local urban runoff contributes 160 kg/yr of mercury to San Francisco Bay. This estimate is based on a very limited dataset of mercury concentrations in bedded sediment in local channels and creeks that was collected for a different purpose and was not meant to be used to develop an estimate of loadings. As the Report states, using the same dataset, BASMAA agencies estimated that the annual loading from local urban runoff was 83 kg/yr. The Report should explicitly state the 95% confidence interval surrounding the 160 kg/yr estimate. It is extremely important the uncertainties surrounding the estimate are clearly stated.

A related issue is the uncertainty regarding the relationship between proposed implementation actions and the proposed 80 kg/yr reduction in urban stormwater loads. The Report provides no indication that there is any link between the proposed implementation actions and the expected load reduction. This linkage needs to be made.

(2) Feasibility of storm water implementation plan

To meet the waste load allocation for urban storm water runoff, the Report provides an Implementation Plan. This plan proposes that storm water dischargers conduct a number of activities including: (1) source control such as promoting the recycling of fluorescent lamps, recycling mercury containing thermometers and other household hazardous waste collection programs; (2) diverting storm water discharges to treatment plants; and (3) treating storm water. Source control programs such as promoting recycling of lamps and thermometers seems reasonable. In fact, the ACCWP has already submitted a Mercury Pollutant Reduction Plan in compliance with Provision C.10.b. of our NPDES permit that takes important steps in this direction. However, diverting flows to treatment plants or treating stormwater to remove mercury may prove infeasible or ineffective.

Diverting Flows: As the Report states, mercury loads from urban runoff are associated with sediment. Since dry weather flows contain almost no sediment and hence, little or no mercury, diverting dry weather flows should not significantly reduce mercury loads. Diverting wet-weather flows appears to be infeasible since treatment plants do not have the capacity to accept large wet-weather flows or sediment-laden flows. If such diversions are to be proposed, which we do not recommend, the acceptance of such diversions should be included in the implementation actions for the wastewater plants.

Treating Stormwater: The Report suggests that the recently adopted stormwater permit requirements related to new development treatment controls should reduce mercury loads. These permit requirements will address new sources but do little to address existing sources except in cases of redevelopment. In addition, the primary methods used to reduce sediment-associated loading are detention basins or wetland treatment systems. In the case of mercury these methods may exacerbate the problem by creating environments that increase mercury methylation.

(3) Disproportionate level of reduction on urban runoff programs

The allocation scheme the Board has proposed places an unfair disproportionate level of reduction on urban storm water dischargers and the Guadalupe River mine remediation relative to other sources. For example, the Report does not propose a waste load allocation for in-Bay dredged material disposal or for local atmospheric sources.

Dredged Material Disposal: The Report states that the average concentration of mercury in dredged material is about 0.37 ppm (p. 25). This is roughly equivalent to the estimated concentration for sediment in urban runoff and about twice as high as the proposed sediment target of 0.2 ppm. The estimated loading from in-Bay disposal is 490 kg/yr (Table 4.5), which is three times as great as the estimated loading from urban runoff. However, the Report seems to indicate that the Regional Board will continue to permit the in-Bay disposal of this contaminated sediment without the imposition of a waste load allocation.

Local Air Sources: The Report estimates that local air sources release 500 kg/yr of mercury (p. 59) and suggests that this source of mercury may be much more bio-available than other sources of mercury (p. 75). However, no allocation is established and no actions are undertaken to reduce local air sources. We suggest that the Board address these local air sources.

It should be noted that atmospheric deposition directly to the Bay is described in the Project Report as “uncontrollable.” The Report also notes that of the roughly 180 kg/yr of mercury from storm water (urban and non-urban), as much as 55 kg/yr could result from atmospheric deposition. Thus, a substantial portion of the storm water runoff mercury discharge is from sources deemed by staff to be “uncontrollable.” Consequently, source control and other implementation plans can only apply to a maximum of about 2/3rds of the estimated storm water mercury loading. This results in urban storm water programs being required to actually achieve significantly more than a 50% reduction of controllable sources. We suggest that the 55 kg/yr attributable to indirect air deposition be removed from the load allocation for urban storm water runoff and assigned to a separate indirect air deposition source category.

At a meeting on November 19th, BASMAA representatives advocated assigning at least a small nominal reduction to air deposition and non-urban runoff rather than zero reductions, to keep the

door open to engage those sources in future adaptive implementation. If no reduction is assigned to such sources, it will be much more difficult to include them in the future if needed. Some of the proposed implementation activities for urban runoff may also remove mercury currently assigned to atmospheric deposition or non-urban runoff. Thus, we suggest at least small reductions for air deposition and non-urban runoff. ACCWP supports the allocation system proposed in the BASMAA letter. Adoption of the BASMAA approach would mitigate our concerns regarding the Report's proposed allocation scheme.

Adaptive Implementation

The "Adaptive Implementation" section of the Report provides an important framework for potential future changes in the implementation plan, and describes important management questions still remaining. As previously stated, we believe that in view of the many scientific uncertainties and unknowns relating to this TMDL, it is essential that flexibility be specifically built into the Project Report. While the Report states that the plan will be reviewed every 5 years through the Basin Planning process, it is critical for the Basin Plan amendment and Basin Planning process to outline clear scenarios for how continuing studies will address these management questions, how the future stakeholder involvement would be coordinated and how the TMDL direction can be changed if appropriate.

In conclusion, we appreciate the opportunity to submit these comments. As previously stated, while the ACCWP is fully committed to implementing a reasonable control plan for the control of mercury discharges to waters of the San Francisco Bay, achievement of the numeric targets cannot be assured without a flexible process that allows appropriate adjustments based on further scientific information and analysis of the results of effective implementation. This must be built into the Basin Plan amendment at the outset to avoid potential future legal problems relating to backsliding and anti-degradation. Finally, we specifically request that staff meet with our Program representatives and BASMAA members to discuss these issues further prior to circulation of the draft Basin Plan amendment and staff report for formal public comment.

Sincerely,

A handwritten signature in cursive script that reads "James Scanlin".

James Scanlin
Management Committee Chair

Copy: Loretta Barsamian, SFBRWQCB
Tom Mumley, SFBRWQCB
Dale Bowyer, SFBRWQCB
ACCWP Management Committee Representatives (via email)

Allen Matkins Leck Gamble & Mallory LLP

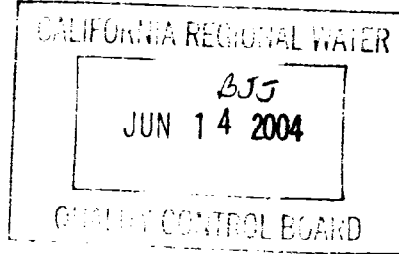
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June 14, 2004

VIA MESSENGER

Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, CA 94612

Attn: Bill Johnson
Richard Looker

Re: San Francisco Bay Mercury TMDL/Proposed Basin Plan Amendment

Dear Sirs and Madams:

On behalf of Buckhorn, Inc. ("Buckhorn"), we offer the following brief comments on the draft report entitled "Mercury in San Francisco Bay: Total Maximum Daily Load (TMDL) Proposed Basin Plan Amendment and Staff Report" (hereinafter, "Plan Amendment").

As you probably are aware, in the latter part of the 1990's, Buckhorn and others, including the County of Santa Clara, participated in the remediation, through removal, consolidation, and stabilization, of calcines (waste products of cinnabar processing) in several locations within the Almaden Quicksilver County Park ("AQCP") in Santa Clara County. The AQCP is situated in the Guadalupe River Watershed, and is the site of legacy mining operations that date back to the mid-1800's. This remedial work was performed under the supervision of, and to the satisfaction of, the Department of Toxic Substances Control (DTSC). Reductions in the mass and concentrations of mercury entering surface waters within the watershed, and hence reductions of the mercury-containing sediment loads in the watershed, were among the objectives, and among the results, of this project.

Although Buckhorn is not a discharger and is not and will not be subject to load allocations under any TMDL in this region, it wishes to point out that the Plan Amendment fails to take into account the impact of this remediation project and, more generally, fails to reflect a fair or reasonably accurate estimate of mercury loadings to the Bay from the Guadalupe River Watershed.

The Plan Amendment roughly estimates an "existing load" of 92 kg/year of mining legacy mercury entering San Francisco Bay from the Guadalupe River Watershed. This rough estimate is the product in part of rough estimates of total sediment loading and fractions of

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sediment loading due to urban and non-urban stormwater runoff. The data, assumptions and methods relied upon to form these estimates may, as the Plan Amendment admits, overstate the sediment load discharged to the Bay; indeed, the admittedly flawed total sediment load figure on which the Plan Amendment bases the calculated mercury load (44 M kg/yr) is about 23% higher than the Santa Clara Valley Water District's estimate of the same figure (34 M kg/yr). No justification for using the higher estimate is provided.

The calculated estimate of mercury loading of 92 kg/year from the watershed is further based upon mercury concentrations in sediment samples collected from 1980-89 at a location upstream from the mouth of Guadalupe River. The sampling data on which the loading estimate is based – a mere sixteen samples – is extremely limited, particularly in light of the consequences that flow from the calculation. Such data also fails to take into account the impact of the remediation project, discussed above, which was conducted in the late 1990's. As a result, the data are, by definition, not relevant to a meaningful estimate of current mercury loading from the watershed. Other commenters made this observation at earlier stages of the development of the Plan Amendment, but the Plan Amendment does not fairly address this problem, and instead relegates the issue inadequately to an uncertain later phase of "adaptive implementation." Moreover, the Plan Amendment proposes specifically recognize only those loads avoided resulting from activities implemented after 2001 as counting toward the load reductions consistent with the load allocation. In this way the Plan Amendment would seem to ensure that the benefits and impacts of the DTSC-supervised remediation will be disregarded, a result that cannot be justified. The Plan Amendment should at least acknowledge that the existing load calculation, and hence the reductions needed to meet the 2 kg/year allocation, are subject to revision. So long as the Plan Amendment continues to reflect calculations based on data that predate the DTSC-supervised remediation project, the Plan Amendment should also acknowledge that load reductions accomplished on account of work performed since that data was collected must be taken into account in assessing the adequacy of the Guadalupe Watershed TMDL to accomplish the disproportionately large reduction that the Bay TMDL contemplates for this source category.

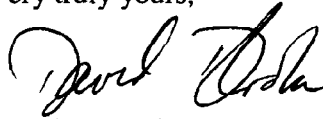
Finally, by definition, and by admission in the Plan Amendment, samples taken from the from U.S. Geological Survey sample station near downtown San Jose could not represent the concentration of mercury in sediments actually entering the Bay, because they reflect neither the impact of tidal actions at the point at which mercury from the watershed may impact the Bay, nor the impact of dredging upstream of that point. In order for the San Francisco Bay TMDL to reflect a reasonably accurate and meaningful existing load estimate for the Guadalupe River Watershed, both of these impacts must be taken into account.

Allen Matkins Leck Gamble & Mallory LLP
attorneys at law

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Thank you for considering these comments.

Very truly yours,

A handwritten signature in black ink, appearing to read "David D. Cooke", written in a cursive style.

David D. Cooke

DDC



Bay Area Clean Water Agencies

Leading the Way to Protect Our Bay

A Joint Powers Public Agency

P.O. Box 24055, MS 702

Oakland, California 94623

June 14, 2004

Mr. Bruce Wolfe, Executive Officer
Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, CA 94612

**Subject: Comments on Mercury in San Francisco Bay TMDL,
Proposed Basin Plan Amendment and Staff Report dated
April 30, 2004**

Dear Mr. Wolfe:

BACWA appreciates the opportunity to continue to work with you and your staff in the development of the Mercury TMDL Basin Plan amendment and supporting documentation. BACWA has worked closely with Regional Board staff on the Mercury TMDL since the beginning of this effort in 1998. We have had numerous meetings and sent a number of letters in the course of our constructive dialog on this topic. The importance of this TMDL lead to the formation of the Clean Estuary Partnership, the collaborative effort of the Regional Water Quality Control Board, the Bay Area Clean Water Agencies, and Bay Area Stormwater Management Agencies Associations, which has supported the preparation of the TMDL. We respectfully request the CEP process be used to address the key concerns we have with changes that have emerged in the April 30 2004 Total Maximum Daily Load, Proposed Basin Plan Amendment and Staff Report, Mercury in San Francisco Bay.-

In brief, these changes are:

1. The pooled allocation for POTWs has been reduced by 18 percent, from 17 to 14 kg/yr. This reduction effectively eliminates any allowance for growth in flows or loads from POTWs over the next 20 years.
2. The averaging period for compliance with the pooled POTW allocation has been reduced from a five-year average to a one-year average.
3. The individual facility "allocations" have been significantly modified in a way that will penalize the communities with the top performing treatment plants.

We respectfully submit that these are unnecessary because:

- POTW loadings to the Bay do not have a significant effect on attainment of TMDL targets or water quality objectives. This is unchallenged in the technical record. A SWRCB scientific peer reviewer has questioned whether it is appropriate to impose a mass cap on the POTW wasteload allocation as a means of attaining TMDL targets (see comments 26 and 27 by professor David L. Sedlak in the administrative record).
- POTWs have agreed to participate in research to address questions regarding the bioaccumulation of mercury from POTW discharges.
- POTWs have implemented and will continue to implement reasonable source control and pollution prevention measures aimed at mercury sources to POTWs.
- Many POTWs currently remove over 95 percent of influent mercury through existing treatment operations.

In addition to the mercury TMDL itself, the April 30 proposals are concerns for future TMDLs because:

- The science does not support a precedent-setting policy to cap all regulated loads in a TMDL, regardless of the magnitude or impact of those loads on the Bay.
- The policy decision to eliminate a growth increment from the mercury wasteload allocation is not supported by the TMDL.

In our comments, we ask for the RWQCB to:

- Maintain the 17 kg/yr pooled allocation amount and associated growth increment from the previous TMDL staff report.
- Restore the 5-year averaging period as was proposed in the previous staff report.
- Eliminate the unnecessary and problematic individual mass "allocations"; the proposed concentration triggers achieve the same purpose in a more effective way.
- Consider and reference previous regional planning documents prepared by RWQCB and draft CEP reports:

- i)i **The Mercury Source Assessment report (Applied Marine Sciences, 2003).**
- i)ii The Wastewater Implementation Report (Larry Walker Associates, 2003).
- i)iii The Inactive Mines Implementation Report (Applied Marine Sciences, 2003).

We have attached our detail comments and full copies of the CEP reports for inclusion in the administrative record.

- B. Through the CEP process, take any steps necessary to make the above CEP draft reports final. Those steps could include consideration by the mercury workgroup, peer review, and consideration by the technical committee.

We request the RWQCB incorporate a model watershed permit into the basin plan amendment. This would allow the regulated community to more fully assess the impact the Mercury TMDL and the basin plan amendment would have on us.

We look forward to working with you resolve the concerns noted herein and to forming a framework to develop subsequent TMDL's.

Sincerely,



James Kelly, Chair
BACWA

Attachments:

1. **Detailed Comments by BACWA on the April 30, 2004 Regional Board Staff Report and Basin Plan Amendment for the Mercury TMDL for San Francisco Bay**

NOTE: The following Attachments are included in the mail version and will be e-mailed individually in the e-mail version due to file size.

2. Watershed Management of Mercury in the San Francisco Bay Estuary TMDL Report to U. S. EPA, June 30, 2000, California Regional Water Quality Control Board San Francisco Bay Region
3. DRAFT STAFF REPORT, Defining the mercury problem in the northern reaches of the San Francisco Bay and designing appropriate regulatory approaches, June 1998, San Francisco Bay Regional Water Quality Control Board
4. Managing Inactive Mercury Mine Sites in the San Francisco Bay Region, July 22, 2003, Khalil Abu-Saba
5. Mercury Source Assessment for San Francisco Bay, March 3, 2003, Khalil Abu-Saba
6. Talus Lex: Regulatory Approaches to Reducing Mercury Concentrations in San Francisco Bay Fish
7. Mercury Management by Bay Area Wastewater Treatment Plants, September 11, 2003, Clean Estuary Partnership

Detailed Comments by BACWA on the April 30, 2004 Regional Board Staff Report and Basin Plan Amendment for the Mercury TMDL for San Francisco Bay

The average annual mercury load from POTWs in San Francisco Bay over the past four years is 11.4 kg/yr. The estimated 2003 mercury load to the Bay is 1220 kg/yr and the proposed mercury wasteload allocation is 702 kg/yr. The POTW load is therefore less than one percent of the total current mercury load and less than 2 percent of the proposed wasteload allocation.

The estimated total mass of mercury in the active sediment layer (assumed in the staff report to be the top 0.15 meters of sediment in the Bay) is 63,000 kilograms. The annual POTW load is therefore 0.02 percent of the mass of mercury in the active sediment layer. The cumulative POTW load over the next 20 years will represent less than 0.5 percent of the total amount of mercury in the active sediment layer of the Bay.

The above numbers, which clearly define the magnitude of POTWs as a very minor mercury source in San Francisco Bay, support the approach taken in the staff report and Basin Plan amendment to allow appropriate flexibility in the establishment of the allocation and implementation measures for POTWs. As noted in the staff report, additional expenditures for treatment at POTWs to further reduce the POTW load would not be commensurate with the resulting benefit in the attainment of TMDL targets.

Consistent with the above rationale, BACWA requests the following changes in the subject documents:

1. Use a 5-year averaging period to assess compliance with the POTW group allocation. The prior version of the staff report had a five-year averaging period for wastewater sources. The current version of the staff report and Basin Plan amendment has a one-year averaging period for wastewater but a five-year averaging period to account for allocations for Central Valley and Guadalupe River watershed loads. The use of the five year averaging period is to account for inter-annual variability in load due to rainfall-induced flow conditions. BACWA believes the five year averaging period is needed for POTWs to account for inter-annual variability of wastewater flows.

The reaction of the Bay to mercury management measures will be a relatively slow process. The staff report states that the overall time frame for recovery is 120 years. Initial load reduction goals will occur within 10 to 20 years. The proposed time periods for target evaluations for fish tissue and bird eggs is every three years. A five-year average loading value for a minor source such as POTWs is consistent with these time frames. It is also consistent with the calculation method used in the derivation of the current POTW load estimate.

2. Revise the group allocation to 17 kg/yr. In prior comments on previous versions of the staff report, BACWA has supported a group allocation to allow for present long-term average loads and an increment to accommodate community

growth and development over the next 20 years. The current version of the staff report recommends a group allocation of 14 kg/yr, based on an annual average POTW mass load estimate of 10.8 kg/yr and an increment of 3.2 kg/yr (through use of a standard error statistic) presumably to address growth and annual variability. As has been discussed with Regional Board staff, the annual average mass load value should be increased to 11.4 kg/yr to correct mathematical errors. This estimate is approximately 1 kg/yr less than the estimate used to develop the 17 kg/yr pooled allocation in the last Regional Board staff report. Given the insignificance of the POTW mass load in the overall Bay mercury budget, BACWA requests that the group allocation for POTWs be set at 17 kg/yr to provide a reasonable growth increment. **BACWA also requests that the staff report and Basin Plan amendment specifically acknowledge that this pooled allocation is intended to address current loads plus a reasonable growth increment.** A similar comment suggesting a specific growth increment allocation was received from one of the independent peer reviewers (Dr. David Sedlak, UC Berkeley) on the TMDL technical report.

Setting the group allocation to 17 kg/yr will not result in the grouped POTW load expanding to 17 kg/yr. On the contrary, one of the BACWA core principles is compliance, so the Water Board can reasonably expect for POTWs to work together to stay well below this maximum.

3. Eliminate the individual mass “allocations” for POTWs. The mass “allocation” approach used in the previous version of the staff report relied upon the relative volumes of discharge to the Bay. The “allocations” presented in the April 30 staff report rely on current loadings. This approach is problematic for several reasons. First, it tends to penalize advanced treatment plants that have the lowest loads per volume of discharge and also have less variable loads. Second, it also tends to penalize plants that have stepped forward to implement reclamation or aggressive pollution prevention and have reduced their loadings to the Bay, accordingly. Finally, it penalizes plants that have remaining un-utilized design capacity and gives extra capacity to plants that will never utilize the “allocation”. The prior allocation scheme tended to reward these plants, which is a more equitable approach. However, the prior allocation scheme also caused some jeopardy to some secondary facilities.

For the reasons cited above, BACWA favors elimination of the individual mass load “allocations” (i.e. the mass load element of the proposed triggers). The mass load triggers are unnecessary and, as noted above, are problematic to individual facilities. The mass load from a given facility is controlled by (a) the NPDES permitted design flow (ADWF) and (b) the concentration trigger. Action is only proposed to be triggered based on exceedance of both the mass and concentration triggers by an individual plant. In all cases, the concentration triggers will control this determination. Therefore, the mass load “allocations”/triggers are unnecessary. Reliance on treatment category-based concentration triggers is preferred, since effluent concentration is a better indicator of plant performance than is mass load and top performing plants benefit most from that approach.

4. Consider and reference previous regional planning documents prepared by Water Board staff. The Project Background (Section 2) could mislead the reader to believe that the April 30, 2004 final TMDL project report for mercury in the Bay was the first major planning effort initiated by the Water Board in response to concerns expressed by USEPA over mercury concentrations in fish. This is not the case. We recommend adding the following paragraph to the Project Background (Section 2), to accurately convey that this stage represents the next step in a process that has been under way for several years:

“A draft strategy for managing mercury in the northern reach of San Francisco Bay was prepared and submitted to the Water Board as an information item on December 16, 1998 (Taylor, 1998). Stakeholder interest in the draft strategy report led to the formation of the San Francisco Bay Mercury Watershed Council in 1999. A preliminary TMDL project report was prepared using USEPA contract funds and presented to the Water Board as an informational item on June 20, 2000 (Abu-Saba and Tang, 2000). This final project report builds upon the policy and science foundation established by those two planning documents.”

The appropriate references for these two planning documents are

- 1) Taylor, K.A, 1998. Managing the mercury problem in the northern reaches of San Francisco Bay and designing appropriate regulatory approaches. California Environmental Protection Agency - San Francisco Bay Regional Water Quality Control Board. December 16, 1998. Oakland, California.
- 2) Abu-Saba, K.E. and Tang, L.W., 2000. Watershed Management of Mercury in San Francisco Bay: a TMDL report to the USEPA, San Francisco Bay Regional Water Quality Control Board. California Environmental Protection Agency. San Francisco Bay Regional Water Quality Control Board. June 20, 2000, Oakland, California.

We note that both of the above mentioned planning documents acknowledge that mercury mass caps for individual POTWs are not necessary to protect beneficial uses. The draft mercury strategy report (Taylor, 1998) proposed “mass offsets” as a means of accommodating growth within the regulatory constraints imposed by the Bay being over its assimilative capacity for mercury. The preliminary project report (Abu-Saba and Tang, 2000) included individual wasteload allocations that allowed room for growth, and did not require mass offsets, proposing instead that actions such as mine site restoration and investigation of ways to reduce mercury methylation are best undertaken through a partnership approach, rather than being leveraged through mass offsets. The partnership approach proposed in Abu-Saba and Tang (2000) led to the formation of the Clean Estuary Partnership, which has funded over \$200,000 worth of technical projects directly supporting Water Board staff in the development of the mercury TMDL final project report that the Board is considering today.

5. Consider and reference draft reports that Water Board staff have requested of the CEP and that the CEP has funded and prepared. Technical

projects sponsored by the CEP have directly contributed to the development of the final TMDL project report, and yet many of the reports produced were not referenced, and the report conclusions have been in some places misrepresented. Proper acknowledgement of information used and relied upon and the CEP's process for internal and external review is essential to make effective use of public intellectual property.

The entirety of Section 3, the Mass Budget Approach, is based on the draft Mercury Source Assessment Report prepared by the CEP. This was one of the first technical projects sponsored by the CEP, and it served as a mechanism for CEP contractors to train Water Board staff who were new to the Mercury TMDL analysis in technical approaches to estimating loads. While Water Board staff have made substantive and original refinements, it is clear that Figure 3.1, Figure 3.2, Equation 1, and essentially all of the calculations and assumptions come directly from that draft report. This needs to be acknowledged. We suggest that the final sentence of the second paragraph in Section 4 (page 18) be amended as follows:

"The estimates are based on available information (Applied Marine Sciences, 2003); more study may allow refinement in the future."

The appropriate reference is:

Applied Marine Sciences 2003. Draft Mercury Source Assessment for San Francisco Bay. Prepared on behalf of the Clean Estuary Partnership. Available at www.cleanestuary.org.

Table 4.1 and Figure 4.1 also appear to be based on the draft Mercury Source Assessment Report, with one important difference. The source assessment report stated all load estimates as best estimates with likely ranges, at the specific direction of Water Board staff, and consistent with the loads assessment approach in the preliminary project report (Abu-Saba and Tang, 2000). The error bars representing the ranges have been eliminated from Figure 4.1, and only the best estimates are represented in Table 4.1. This is bad science, as all quantitative statement should include some statement of uncertainty. Bad science could lead to bad policy decisions by creating false expectations about the magnitude of controllable watershed loads. In practice, this uncertainty has been recognized, and is the basis for a recent \$100,000 CEP project to assess the feasibility, costs, and expected benefits of reducing mercury loads in urban stormwater. We request that Figure 4.1 and Table 4.1 be amended to include the uncertainty of each load estimate. Doing so will help the Water Board and the public to understand why the next logical step in implementation for some sources, such as urban stormwater, is to reduce uncertainty.

In August of 2002, Water Board staff made a specific request of the CEP that implementation reports be prepared describing the approach, costs, and expected benefits of TMDL implementation for different source categories. The

Implementation Plan (Section 8) fails to reference the reports produced that describe implementation approaches for wastewater and inactive mines, and as a result omits crucial information.

The Wastewater Implementation Report clearly defines an approach to estimating current mercury loads and predicting future mercury loads from POTWs, and supports the Basin Planning effort by providing cost estimates for different load allocation scenarios. The report also describes, at a conceptual level, the approach to assessing the extent to which mercury discharge from POTWs affects methylmercury in receiving waters. This is all essential information that needs to be considered by the Water Board.

We request that you make the following changes:

In Section 8, under the heading Wastewater, subheading Municipal Discharges (Page 74) make this the opening paragraph:

“Since 2000, when POTWs implemented ultra-clean mercury monitoring at the direction of the Water Board, the estimate for the existing load from POTWs has been reduced from the previous estimate (Abu-Saba and Tang, 2000) of 44 kg/yr (range = 25 – 62 kg/yr) down to 11.4 kg/yr (range = 8.5 – 14.3 kg/yr) (Larry Walker Associates, 2003; Larry Walker Associates, 2004). If POTWs maintain current levels of performance, projected population growth in the Bay Area would increase that load by a total of 2 kg/yr over a twenty-year period. If the Water Board does not allow the long term annual average to increase with population growth, the cost of maintaining the annual average POTW load at current levels is estimated to be between \$8,000,000 and \$25,000,000 per year, depending on the approach. If the Water Board requires reductions in annual average POTW mercury load from current levels, the cost to implement ranges from \$100,000,000 per year to almost \$1,000,000,000 per year, depending on the approach (Larry Walker Associates, 2003).”

Providing the information above in the document will help the Water Board fulfill its duties pursuant to Section 13242 of the California Water Code.

In Section 8, under the heading Wastewater, subheading Municipal Discharges (Page 74) amend the text of the third paragraph as follows:

“The potential availability of wastewater mercury for methylation and biological uptake, and possible local effects of such discharges, is not well understood. We propose that dischargers undertake or otherwise support studies to evaluate local impacts and bioavailability. A recent assessment of methylmercury in receiving waters conducted by the Fairfield-Suisun Sewer District is an example of such a study. That study showed no difference in the production of methylmercury between the receiving slough of the advanced treatment plant and a reference slough. In that study, dissolved oxygen in the receiving waters was a much more important variable than the nature of the mercury source (as summarized in Larry Walker Associates, 2003 and Abu-Saba et al., 2001). Similar information is needed from a variety of treatment plant types and discharge locations, as well as

more direct assessments of the potential for localized increased mercury in the food web (e.g., benthic invertebrates in receiving waters).

If evidence of local effects from wastewater effluents....” (leave the rest of the paragraph as written).

We note the Fairfield-Suisun Sewer District methylmercury assessment was conducted as a special study in compliance with a negotiated provision in their NPDES permit. The methylmercury measurements were made by Dr. Robert P. Mason, a recognized expert in mercury biogeochemical cycling. Dr. Mason also reviewed the results and conclusions of that study, and was a co-author when the results were presented in a special session on mercury at the American Geophysical Union’s annual meeting in December, 2001 (Abu-Saba et al., 2001). Water Board staff currently leading the TMDL unit also attended that session and co-authored that presentation.

The mine site implementation report assessed the status of implementation of the Basin Plan program for inactive mines with respect to mercury mines in the Bay Area. That report summarized the status and priority of mercury mines, proposed next steps to assure full implementation of the mines program, and provided a framework for estimating staff time and contract dollars needed to fully implement the mines program. That information needs to be considered and referenced.

We request you make the following change to Section 8, heading Potential Sources, Subheading Mercury Mines (page 79), second paragraph, first sentence:

“Approximately seven small mercury mines located in the North Bay are not meeting the conditions set forth in the Basin Plan. Priorities and next steps to assure full implementation have been identified (Applied Marine Sciences, 2003).”

It is not clear to us whether Water Board staff have sufficient resources to fulfill the implementation commitment made in this paragraph. If not, that needs to be said, so that those resources can be sought from the legislature, federal grant programs, or funding partnerships.

The appropriate references for the two implementation reports and the AGU presentation discussed above are:

Larry Walker Associates, 2003. Draft report on Mercury Management by Bay Area Wastewater Treatment Plants: approaches, costs, and benefits of alternative scenarios for implementing the San Francisco Bay Mercury TMDL in municipal and industrial National Pollutant Discharge Elimination System permits. Prepared on behalf of the Clean Estuary Partnership, available at www.cleanestuary.org.

Applied Marine Sciences, 2003. Draft report on Managing Inactive Mercury Mine Sites in the San Francisco Bay Region: status report on implementation of the Basin Plan mines program. Prepared on behalf of the Clean Estuary Partnership, available at www.cleanestuary.org.

Abu-Saba, K.E.; Flegal, A.R.; Ganguli, P.M.; Whyte, D.C.; Mumley, T.E.; Mason, R.P., 2001. Talus Lex: Regulatory Approaches to Reducing Mercury Concentrations in San Francisco Bay Fish. EOS Transactions of the American Geophysical Union, 82(47), Fall Meeting, Supplemental Abstract H52F-08. December 14, 2001, San Francisco, California.

6. Through the CEP process, take any steps necessary to make the above CEP draft reports final. Those steps could include consideration by the mercury workgroup, peer review, and consideration by the CEP Technical Committee.

While all of the above reports produced by the CEP are still referred to as drafts, information from each report was selectively used by Water Board staff in the preparation of the Mercury TMDL Final Project Report. The information used by the Water Board is important and needs to be considered in the full context of the reports. The Reports were publicly funded and prepared to support the TMDL effort; the reports need to be recorded in a final form. The CEP has a process for bringing draft reports to final. That process is in the control of the mercury workgroup of the CEP technical committee, which is chaired by Water Board staff. In the interim between the first public hearing of the Mercury TMDL and the hearing to consider adoption, we request that Water Board staff support the CEP process for bringing the draft reports to final products representing the consensus of the partnership. The CEP has an existing budget for workgroup deliberations and external peer review, so this request does not represent an additional burden.

Watershed Management of Mercury

in the

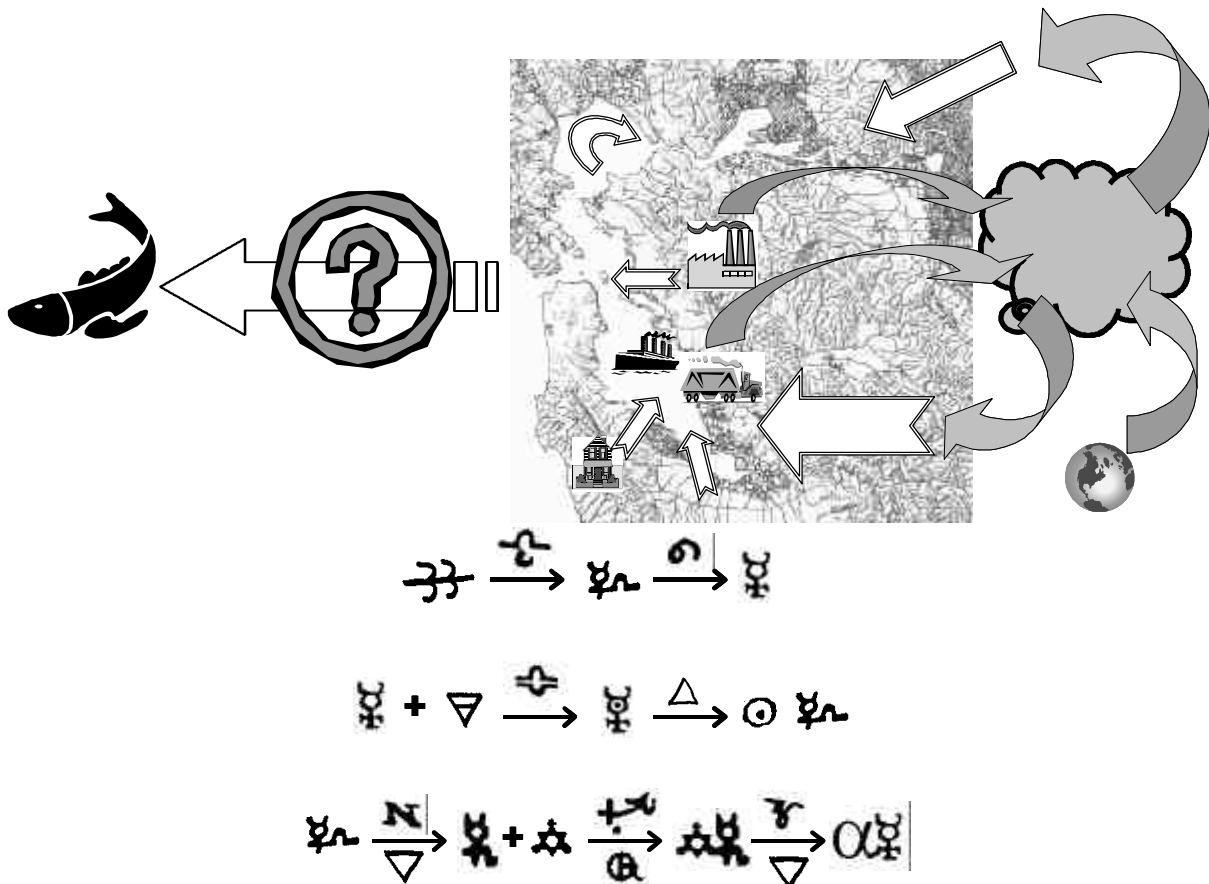
San Francisco Bay Estuary:

Total Maximum Daily Load

Report to U.S. EPA

California Regional Water Quality Control Board
San Francisco Bay Region

June 30, 2000



Acknowledgements, Authorship, and Dedications

This report is a synthesis of science, policy, values, and ideas brought forward by a diverse group of stakeholders. Literally hundreds of participants have engaged staff of the California Regional Water Quality Control Board on the subject of mercury in the environment; their interest and participation are greatly appreciated. Many individuals have directly contributed time, thought, and energy into this report and the deliberations leading to it, and should be recognized explicitly. Their names appear on the following two pages.

“Let every man make known what kind of government would command his respect, and that will be one step toward obtaining it.”

Henry Thoreau, *Civil Disobedience*

"And now, let the wild rumpus start!"

Maurice Sendak, *Where the Wild Things Are*

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Cover design by Khalil Abu-Saba. The upper section depicts the numerous pathways conveying mercury into the aquatic ecosystem of the San Francisco Bay estuary, and the uncertainty about how mercury from each pathway is bioaccumulated. The lower section depicts the biogeochemical cycle of mercury, in seventeenth century alchemical symbols, from cinnabar, to quicksilver used in gold amalgamation, to inorganic mercury, to methylmercury in fish.

Mercury TMDL Report for San Francisco Bay 8/1/00

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San Francisco Bay Mercury Council participants and other contributors. We thank each of these individuals for their assistance, advice and perspectives. The policy guidance contained in this report does not necessarily reflect the views or positions of the agencies and organizations represented.

Mercury TMDL Report for San Francisco Bay 8/1/00

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6.2 Load and wasteload allocations for Lower South Bay

The assimilative capacity in lower South Bay is estimated to be 29 kilograms per year. That load is allocated among point and nonpoint sources as specified in Table 33. To provide a margin of safety, we have included an unallocated load of 4 kg per year.

Source	Type	Current (kg/yr)	Allocated (kg/yr)
Fremont Bayside	Watershed	2	2
Coyote Creek	Watershed	8	8
Guadalupe River	Watershed	49	4
Palo Alto	Watershed	6	6
Direct Air Deposition	Background	1	1
Unallocated reserve	Background	NA	4
City of Palo Alto	Municipal	0.25	0.6
City of Sunnyvale	Municipal	0.10	0.3
City of San Jose	Municipal	0.80	2.8
FMC Newark	Industrial	?	0.5
Total		67	29

Table 33: Load and wasteload allocations (kg/yr) for sources in Lower South Bay.

The burden of reduction is placed upon the most egregious mercury source in Lower South Bay, the Guadalupe River watershed, which drains the New Almaden Mining district. The load reduction for that watershed is predicated on implementation of control measures that reduce the median concentration of mercury in sediments transported from that watershed from their current level of 2.5 µg/g to 0.2 µg/g, comparable to adjacent watersheds. The same level of reduction could also be achieved by reducing sediment loads exported from the watershed. Regardless of how the reduction is achieved, we will require attainment of the sediment target of 0.4 µg/g (normalized to fines) for sediments exported from all watersheds, including the Guadalupe River.

The wasteload allocations for the three municipal dischargers in Lower South Bay assume that the treatment plants can maintain an annual average mercury concentration of 0.007 µg/L or less, and that flows increase to no more than double current levels due to growth. Those wasteload allocations, which allow some increase in wastewater loads, are proposed in accordance with U.S. EPA guidance for the development of phased TMDLs: “the phased approach is required when the TMDL involves both point and nonpoint sources and the point source wasteload allocation is based on a load allocation for which nonpoint source controls need to be implemented.”⁸⁴.

In the implementation plan, we will establish a time to review the TMDL, evaluate progress towards attainment of the load reduction from the Guadalupe River watershed, and decide whether additional, more stringent control measures are needed to attain the target.

It is important to quantify the effects, in terms of reduced environmental benefit, that could result from allowing wastewater sources to increase as watershed sources decrease. For example, consider the purely hypothetical case of a discharger that only needs a pound of mercury. How much difference would one more 1 pound, (0.45 kilograms) make, in terms of attaining the target? If the proposed load reduction of 45 kg is attained, then adding another pound of mercury would add another 3 months to the 17 years required to attain the sediment target. The proposed allocations allow a total increase of 3 kg for all wastewater sources. How does this increase affect the time to attain the target?

Figure 43 shows that the answer entirely depends on the load reduction attained from the Guadalupe River watershed. We propose a reduction of 45 kilograms per year from that watershed. Reserving 4 kg per year as a margin of safety makes the net load reduction 41 kg per year. This would lead to attaining the sediment target in 17 years (Scenario A). An additional 3 kg from wastewater discharges would increase the time to attain the target to 18 years. But what if only 20 kilograms per year are reduced from the Guadalupe River, while point sources concurrently increase by 3 kilograms (Scenario B)? In that case, allowing the growth in point sources would cost an extra 6 years in terms of time to attain the target. And if a mere 10 kilograms per year are reduced from the Guadalupe River Watershed (Scenario C), then what would be the effect of an extra 3 kg? Under Scenario C, the extra mercury from the point sources extends the time to attain the target by 30 years.

It is also worth asking what would happen if we completely ignored the Guadalupe River watershed, and focused instead on reducing wastewater sources, which amount to 1.2 kilograms. Reducing mercury loads in Lower South Bay by 1.2 kilograms might lead to attaining the sediment target in 586 years.

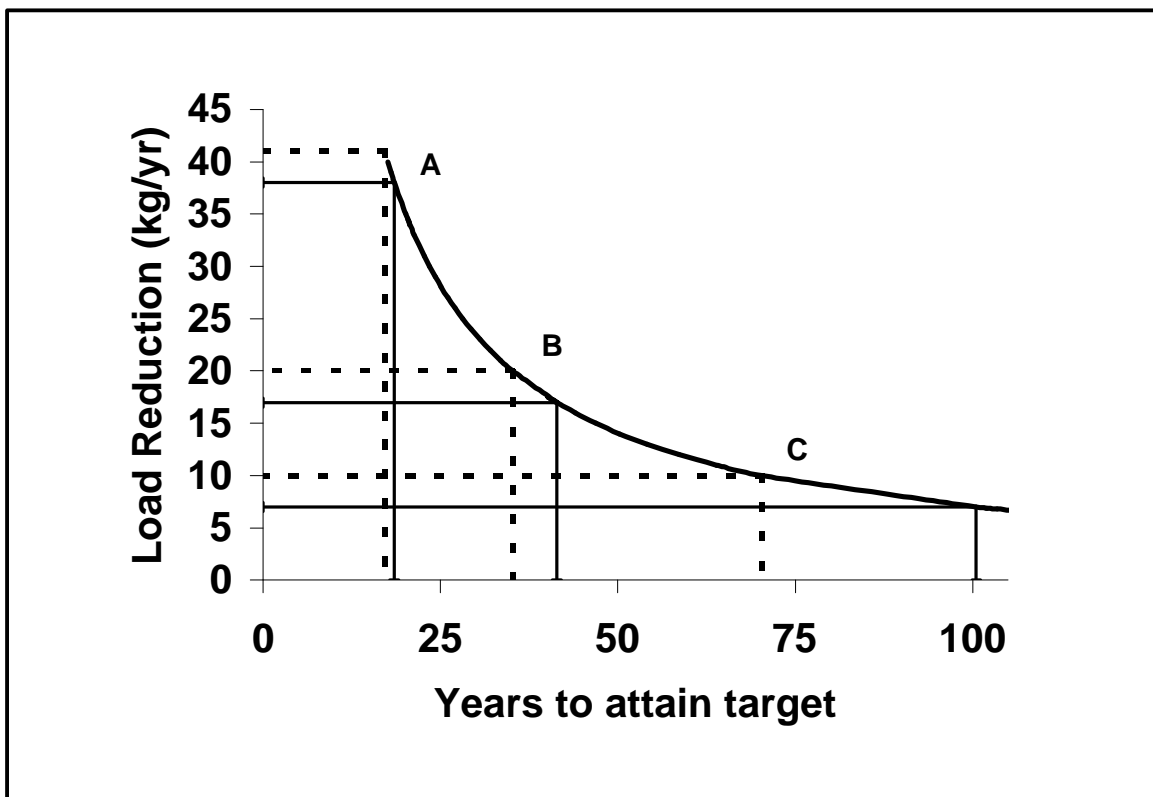


Figure 43: Figure showing the coupling between wasteload allocations for point source discharges in Lower South Bay and the load reduction attained from the Guadalupe River watershed. The dashed horizontal and vertical tie-lines depict load reductions of 41, 20 and 10 kg per year from the Guadalupe River watershed. The solid tie-lines depict the corresponding net load reduction to Lower South Bay if point sources are concurrently allowed to grow by 3 kg.

6.4 Wasteload allocations for wastewater dischargers in all other Bay segments

Of all known sources, wastewater dischargers have attained the most substantial mercury reductions over the past three decades, by investing over two billion dollars in construction of wastewater treatment systems. This report shows that in order to protect beneficial uses, we have to focus on watershed sources. Nonetheless, a complete watershed plan must also put reasonable limits on the mass of mercury released from wastewater sources.

In the Bay Area, current wastewater dischargers release between 25 and 63 kg of mercury per year. We have recently required better mercury measurements from all wastewater dischargers, and expect this estimate to be refined to 15-40 kg per year as new data are produced. Even though Bay segments north of the Dumbarton Bridge appear to be below their assimilative capacity, some level of control on point sources is needed to protect beneficial uses.

The sum of wasteload allocations for wastewater should be less than 50 kg in the entire San Francisco Bay watershed. This mass is derived from the sediment budget for San Francisco Bay (Table 15) and the Basin Plan narrative objective for bioaccumulation: “Controllable water quality factors shall not cause a detrimental increase in concentrations of toxic substances found in bottom sediments or aquatic life.”

Every year, 3.7 billion kilograms of sediment are deposited in San Francisco Bay. If we limit total wastewater mercury loads 50 kg or less, the mercury concentration of bottom sediments would be at most 0.013 mg/kg higher than they would be in the absence of wastewater loads. Thus, the proposed limit for wastewater makes two assumptions:

- 1) Mercury loads from wastewater are entirely adsorbed onto sediments (an environmentally conservative assumption);
- 2) 0.013 mg/kg is not a detrimental increase in the mercury concentration of bottom sediments, which average 0.3 mg/kg in San Francisco Bay.

This proposed load should be allocated to individual sources according to the vulnerability of the receiving waters. Shallow receiving waters have longer residence times, and are more prone to the suboxic conditions that promote mercury methylation. Therefore, shallow water discharges should get proportionally lower wasteload allocations than deep water discharges.

We have also considered technological feasibility in allocating individual loads. A recent study by the Association of Metropolitan Sewage Agencies (AMSA) using modern analytical techniques shows that 90 percent of the effluent mercury values in the dischargers examined were at or below 0.015 µg/L. Therefore, we can reasonably expect that any treatment plants in the Bay Area to maintain an annual average effluent concentration of 0.025 µg/L or less. Plants with shallow water outfalls should show better performance, because their receiving waters are more vulnerable. Based on the AMSA study, we can reasonably expect plants with shallow water outfalls to maintain an annual average effluent concentration of 0.015 µg/L or less.

We have derived individual WLAs using these two performance goals (0.025 µg/L and 0.015 µg/L), and double current flow rates. The sum of these mass limits for all municipal and industrial dischargers is less than 50 kg. This approach limits total masses of mercury released from wastewater discharge to levels very close to current performance, while allowing reasonable room for growth and placing the burden of increased treatment on facilities with the poorest performance. We will continue to investigate possible linkages between wastewater inputs and methylmercury production. As we refine the methylmercury target and gain a better understanding of methylmercury distributions in the estuary, it may be necessary to impose more stringent mass limits on individual wastewater dischargers in the second phase.

Wasteload allocations for municipal dischargers are summarized in Table 34, Figure 44, and Figure 45. Wasteload allocations for industrial dischargers are summarized in Table 33 and Figure 46.

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Facility	Bay Segment	Map Key	Wasteload Allocation (kg/yr)	Best Estimate of annual flow (MGD)	Annual average mercury concentration target (µg/L)
San Jose/Santa Clara WPCP	A	23	2.8	120.1	0.007
East Bay MUD	C	9	6.4	77.3	0.025
EBDA, East Bay Dischargers Authority	B	8	6.4	76.8	0.025
City & Co. of S.F., Southeast	B	21	6.2	75.0	0.025
Central Contra Costa S.D.	E	4	3.8	45.8	0.025
City of Palo Alto	A	19	0.6	25.7	0.007
So. Bayside System Authority	B	29	1.7	20.7	0.025
West County Agency	C	34a	1.4	16.5	0.025
City of Sunnyvale	A	32	0.3	14.6	0.007
Napa S.D.	D	15	0.7	14.2	0.015
Delta Diablo S.D.	E	7	0.7	13.6	0.015
City of San Mateo	B	24	1.1	13.1	0.025
Fairfield Suisun Sewer Dist.	E	10	0.6	12.8	0.015
Vallejo Sanitation & Flood Cont.	D	33	1.0	12.5	0.025
LAVWNMA, Livermore-Amador Valley WMA	B	8a	0.9	11.0	0.025
Central Marin Sanitation A.G.	C	5	0.9	10.9	0.025
So. S.F./ San Bruno WQCP	B	30	0.8	10.2	0.025
City of Petaluma	D	20	0.5	10.1	0.015
West County Wastewater Dist.	C	34b	0.6	6.7	0.025
Novato S.D.	D	17	0.3	6.1	0.015
City of Burlingame	B	2a	0.3	4.1	0.025
Sewerage Agency of So. Marin	C	27	0.3	3.1	0.025
Sonoma Valley County S.D.	D	28	0.1	2.8	0.015
City of Pinole	D	11a	0.2	2.3	0.025
City of Benecia	E	1	0.2	2.3	0.025
City of Millbrae	B	2b	0.2	1.9	0.025
Las Gallinas Valley S.D.	D	12	0.1	1.7	0.015
Mountain View S.D.	E	14	0.1	1.5	0.015
Sausalito-Marin City S.D.	C	25	0.1	1.4	0.025
City & Co. of S.F., Int. Airport	B	2c	0.1	0.9	0.025
Marin Co. S.D. #5	C	13	0.1	0.8	0.025
Rodeo S.D.	D	11b	0.1	0.7	0.025
City of Calistoga	D	3	0.0	0.6	0.015
City of Hercules	D	11c	0.0	0.4	0.025
Town of Yountville	D	35	0.0	0.4	0.015
City of St. Helena	D	31	0.0	0.3	0.015
Contra Costa Co. S.D. No. 5	E	6	0.0	0.0	0.025
Total			40		

Table 34: Summary of annual wasteload allocations for municipal dischargers in the San Francisco Bay region.

Mercury TMDL Report for San Francisco Bay 8/1/00

Facility	Bay Seg- ment	Map Key	Wasteload Allocation (kg/yr)	Best Estimate of annual flow (MGD)	Annual average mercury concentration target (µg/L)
C&H Sugar Co.	D	2	2.0	24.5	0.025
Chevron U.S.A.	D	3	0.5	6.0	0.025
Equilon Enterprises LLC.	E	8	0.4	5.3	0.025
Tosco Corp. Avon Refinery	E	11	0.4	4.3	0.025
Dow Chemical Co.	E	4	0.2	2.2	0.025
Exxon	E	5	0.2	1.9	0.025
Tosco Corp. Rodeo Refinery	D	12	0.1	1.6	0.025
San Francisco Int. Airport	B	16	0.1	0.9	0.025
General Chemical Corp. Bay Point Works	E	1	0.0	0.3	0.025
Rhone Poulenc Basic Chemical Co.	E	9			0.025
Zeneca Agricultural Products	C	10			0.025
USS Posco	E	13	0.8	9.1	0.025
FMC Newark	A	6	0.5		
PG&E Portrero Power Plant	B	13	0.1	202.0	0.0002
GWF Power System, Nichols Road Power Plant	E	14	0.0	0.0	0.025
GWF Power System, East Third Street Power Plant	E	15	0.0	0.1	0.025
Total			4.8		

Table 35: Summary of annual wasteload allocations for industrial dischargers in the San Francisco Bay region.

Mercury TMDL Report for San Francisco Bay 8/1/00

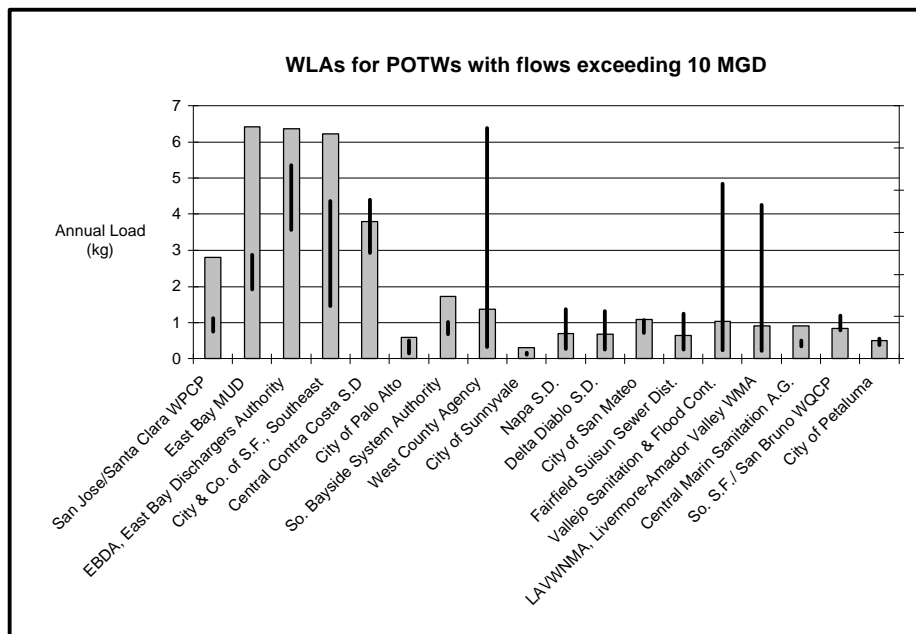


Figure 44: WLAs (solid Grey bars) and current performance (black vertical lines) of municipal wastewater dischargers with flows exceeding 10 million gallons per day.

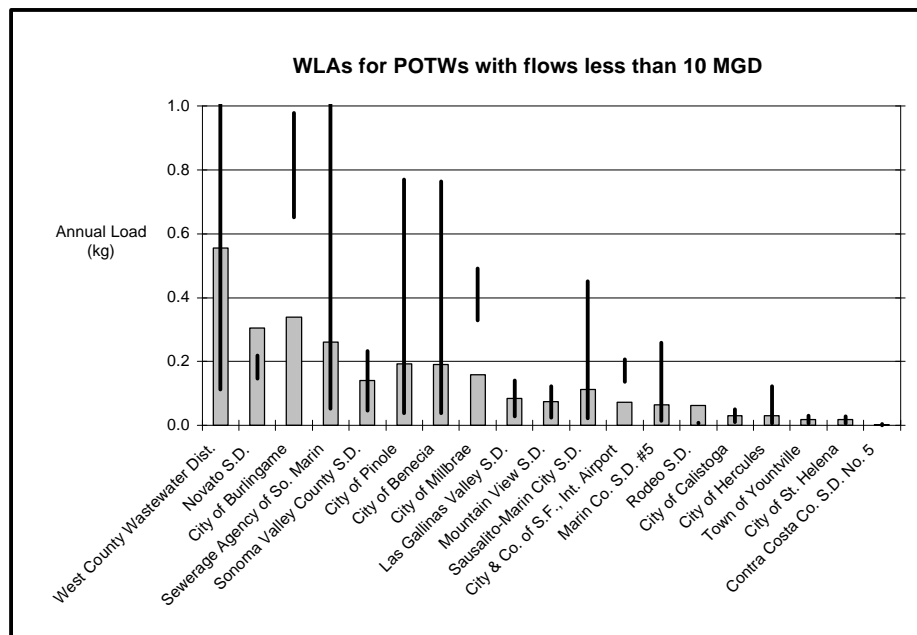


Figure 45: WLAs (solid Grey bars) and current performance (black vertical lines) of municipal wastewater dischargers with flows less than 10 million gallons per day.

DRAFT STAFF REPORT

Defining the mercury problem in the northern reaches of San Francisco Bay and designing appropriate regulatory approaches

June, 1998

San Francisco Bay Regional
Water Quality Control
Board



This work is the product of many hours of discussions, inquiries, research, data analysis, and writing. Tobi Tyler (ABAG) and Dr. Keith Casey (Sea Grant) compiled technical information and wrote this report. Mark Ruderman, Blair Allen, Katie Hart, Dale Boyer, Greg Walker, and Larry Kolb all contributed by spending time discussing the issue as an internal issue team. Selina Louie contributed her knowledge of the pollution prevention program successes and status. The managers and staff responsible for data management at all of the POTWs discharging upstream of Central Bay contributed by quickly responding to a special data request from the mercury team, sending us electronic copies of their discharge data. Dyan Whyte and Ron Gervason provided critical comments and editing. Kim Taylor directed the project.

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I. The Mercury Situation—Executive Summary

Mercury in the San Francisco Bay (Bay) aquatic system is found in concentrations that exceed standards both in fish and shellfish and periodically in Bay waters themselves. The observed mercury levels in tissue are the end product of historical and ongoing inputs, complex transport mechanisms, biogeochemical process that transform mercury in the water, sediment, and marshes, and uptake of organic mercury into the food chain.

This document presents a proposed policy and regulatory program for mercury in watersheds draining to the northern embayments of the San Francisco Bay Estuary.¹ Staff have developed these proposed Basin Plan amendments in order to achieve full protection of water quality in a manner that emphasizes reductions in the largest, controllable ongoing sources of mercury to the system, considering the rate of natural cleanup processes and existing stocks of mercury in the Bay. This staff report includes:

- A thorough review of mercury levels in the Bay environment (water quality conditions);
- A definition of the environmental problems unique to mercury;
- A review of relationships between environmental conditions and mercury sources and flows in the watershed;
- A review of the current regulatory program;
- An analysis of potential measures for controlling ongoing inputs and long-term remediation;
- Design of a new administrative tool (mass offsets) to promote the use of cost-effective control measures; and
- A set of proposed policy and regulatory program elements (Basin Plan amendments) designed to address and reflect the assessments described above.

A. Environmental Conditions and Concerns

1. Narrative and Numeric Water Quality Objectives

The Office of Environmental Health Hazard Assessment (OEHHA) has reviewed all available data on health risks associated with consumption of mercury in fish, dietary concentrations, and concentrations in fish caught in the Bay. The first set of reviews was conducted in the early 1970s, after which OEHHA (then DHS) issued a formal health advisory warning against excessive consumption of striped bass in all of the embayments that make up San Francisco Bay. Subsequent reviews of fish tissue data in 1993 and 1997 supported earlier findings.

¹ This draft staff report and proposed policies were designed to cover Central Bay north of Alcatraz Island, San Pablo Bay, Carquinez Strait, Suisun Bay, the western Delta and tributaries to these waters. We anticipate including loading information on discharges to the Central Bay north of the Hunter's Point-San Leandro line dividing South from Central Bay during the comment period. Additionally, we are seeking comments on whether to extend the policy proposals to include south bay segments as well.

Fish tissue monitoring has been expanded in recent years to better define the extent of the bioaccumulation problem by sampling a broader variety of fish species and the extent of the human health risk by more precisely defining consumption patterns. The latest compilation of fish tissue data indicates that mercury levels in shark, white croaker, and other species are also high enough to warrant public health concerns. The health advisory thus remains in effect, meaning that San Francisco Bay (Bay) is not fully supporting the Water Contact Recreation (Rec-1) and Ocean, Commercial, and Sport Fishing (Comm) beneficial uses or the general narrative standard of “fishable” in the federal Clean Water Act.

In addition to these violations of “narrative” water quality standards, numerical water quality objectives are frequently exceeded in all embayments. Measurements of mercury in Bay waters are frequently above the 0.025 µg/L saltwater and 0.012 µg/L freshwater Basin Plan objectives. Ambient concentrations exceeded objectives in about $\frac{1}{4}$ of all Regional Monitoring Program (RMP) measurements south of San Bruno shoal (Alameda-Hunters Point) and in about $\frac{1}{3}$ of all measurements taken in San Pablo Bay and upstream into the Sacramento-San Joaquin Delta system. Although there is a consistent pattern of exceedances, recent data analyses indicate that total mercury in the water column is influenced by suspended sediment concentrations, not increases in Bay mercury. Thus, while exceedances are observed, they do not represent changes in environmental risk.

The second conclusion that can be drawn based on ambient monitoring data is that mercury in the Bay system poses a specific type of risk to beneficial uses. That risk is confined to bioaccumulation. Ambient concentrations are never high enough to warrant concern about short-term mercury-related toxicity. The Bay system is thus in compliance with federal aquatic life criteria.

In summary, many of the existing data sets show a consistent pattern of long-term, mercury bioaccumulation in the Bay environment with the most affected species being long-lived fish, birds, and mammals at the top of the food chain. Mercury tissue concentrations in these types of aquatic organisms are typically above both the formal available endpoints for human health risk (current elements in US EPA’s national mercury criteria) and alternative endpoints being considered as part of a revision of the national criteria. This proposed regional policy and regulatory program thus focuses entirely on the problem of persistent bioaccumulation.

2. Mercury in the Bay Environment

Current mercury concentrations in fish tissue range from a 0.9 ppm average for shark and about 0.3 ppm for white croaker and striped bass, compared to 0.1 ppm average for fish from all US waters. Although bivalves are not very sensitive indicators of mercury bioaccumulation, mean concentrations in transplanted bivalves placed in all San Francisco Bay embayments are about 0.5 ppm—or among the highest 5% of concentrations found statewide in the State Mussel Watch Program and higher than most other west coast sites monitored by NOAA. There is much less information on mercury concentrations in other organisms, but elevated samples have been found in harbor seals, night herons, and clapper rails living in the Bay environment.

Mercury concentrations in Bay waters range from 0.0001 to 0.105 µg/L (total) and less than 0.0001 to 0.00271 µg/L dissolved. Peak total concentrations are observed during wind-, tide-, and

flow-driven sediment suspension; peak dissolved concentrations are expected with first flush/peak flow events in tributary rivers. At these concentrations, no toxicity-related effects are expected.

Mercury concentrations in the upper layer of Bay sediments are relatively homogenous, averaging about 0.35 ppm with slightly higher concentrations in samples with finer particle grains and higher than average amounts of organic material. This upper layer provides habitat for bottom-dwelling organisms that tunnel through and mix sediments and is also subject to resuspension and redeposition—sometimes as frequently as every day. There is a deeper layer of sediment, deposited after the Gold Rush, containing much higher average amounts of mercury (up to 1 ppm) lying in a concentration gradient from the western Delta to the Golden Gate.

Studies to define what chemical forms of mercury are being measured in the Bay system are not yet practical to use in routine monitoring. However, it has been well-established that virtually all of the mercury found in tissue is organic—and that virtually all of the mercury found in ambient waters and sediment is inorganic and bound within or attached to particles. This inorganic, particle-bound material is also likely to be a complex mixture of mineral, “reactive,” and elemental mercury. Bacteria are responsible for transforming “reactive” mercury into bioavailable organic mercury. The key to managing bioaccumulation, then, is understanding how the mixture of particle-bound inorganic mercury becomes methylated, and what human actions influence these processes.

The current state of knowledge about mercury transformation processes can provide a map of what those processes are and the kinds of factors that influence them, but is far from being able to quantifying the net production of methyl mercury given specific information on inorganic inputs. Because of this difficulty, tissue concentrations remain the best indicator of net methylation in aquatic systems.

B. Mercury Inputs to the Sacramento River/San Francisco Bay Watershed

There are two sources of mercury to the San Francisco Bay system, historic loadings dating from Sierra and Coast Range mercury mining activities during the Gold Rush, and ongoing loadings from a range of sources including: worldwide and local fossil fuel combustion; trace impurities in widely used products; ongoing erosion and drainage from mine sites; and use of the metal. Of these two classes of sources, historic practices account for the vast majority of mercury both in and currently entering the aquatic system—most of this load is associated with sediment particles and flows down the Sacramento River watershed and into the northern embayments. At historic Coast Range mining sites, mercury loadings to the watershed are typically from tailings piles and uncontrolled discharge from abandoned mines. In the Sierra, mercury loadings are much more diffuse and are typically spread through sediments along many miles of river systems downstream from gold mining sites. Locally, historic practices have left isolated sites along the margins of the Bay and local streams with significant areas of contamination. Runoff and erosion from these areas also account for a significant, ongoing mass input to the Bay system. Remediation and containment is currently underway at most local sites where high concentrations of mercury have been found.

The layer of enriched sediment, stretching from the mouth of the Sacramento/San Joaquin Rivers to the Golden Gate, deposited during the Gold Rush is also a significant ongoing source of mercury. Sediment from the deep layer mixes into cleaner surface sediments whenever the Bay

floor erodes; conversely, the layer is buried deeper in areas where sediment deposits. This mixing process is extremely patchy and impossible to predict. Nevertheless, current information suggests that natural sediment flux processes are slowly burying this layer below the biologically active zone.

Ongoing inputs of mercury to the Bay system due to current practices include atmospheric deposition, improper disposal of products such as paint in storm drains, use of products such as bleach containing trace impurities of mercury, and direct use of mercury in thermometers, medical equipment, dental amalgam. These ongoing loadings enter the Bay system through storm drain systems, treatment plants, and direct atmospheric fallout onto the Bay. The total mass of ongoing loadings is small compared to historic sources, but the chemical form of mercury is mostly “reactive” mercury and much more readily converted into bioavailable forms.

The largest inputs to the Bay are from the Sacramento River watershed and the enriched deep sediment layer. Atmospheric deposition onto the upland, urban areas of local watersheds and subsequent discharge through storm drains may be comparable to the riverine and deep sediment inputs. In comparison, estimating loading from local streams, all regulated treatment plant discharges, and direct atmospheric deposition onto Bay waters are all two orders of magnitude less than the largest inputs.

A summary of mercury flows in and out of the northern embayments is presented in Figure 1 below.

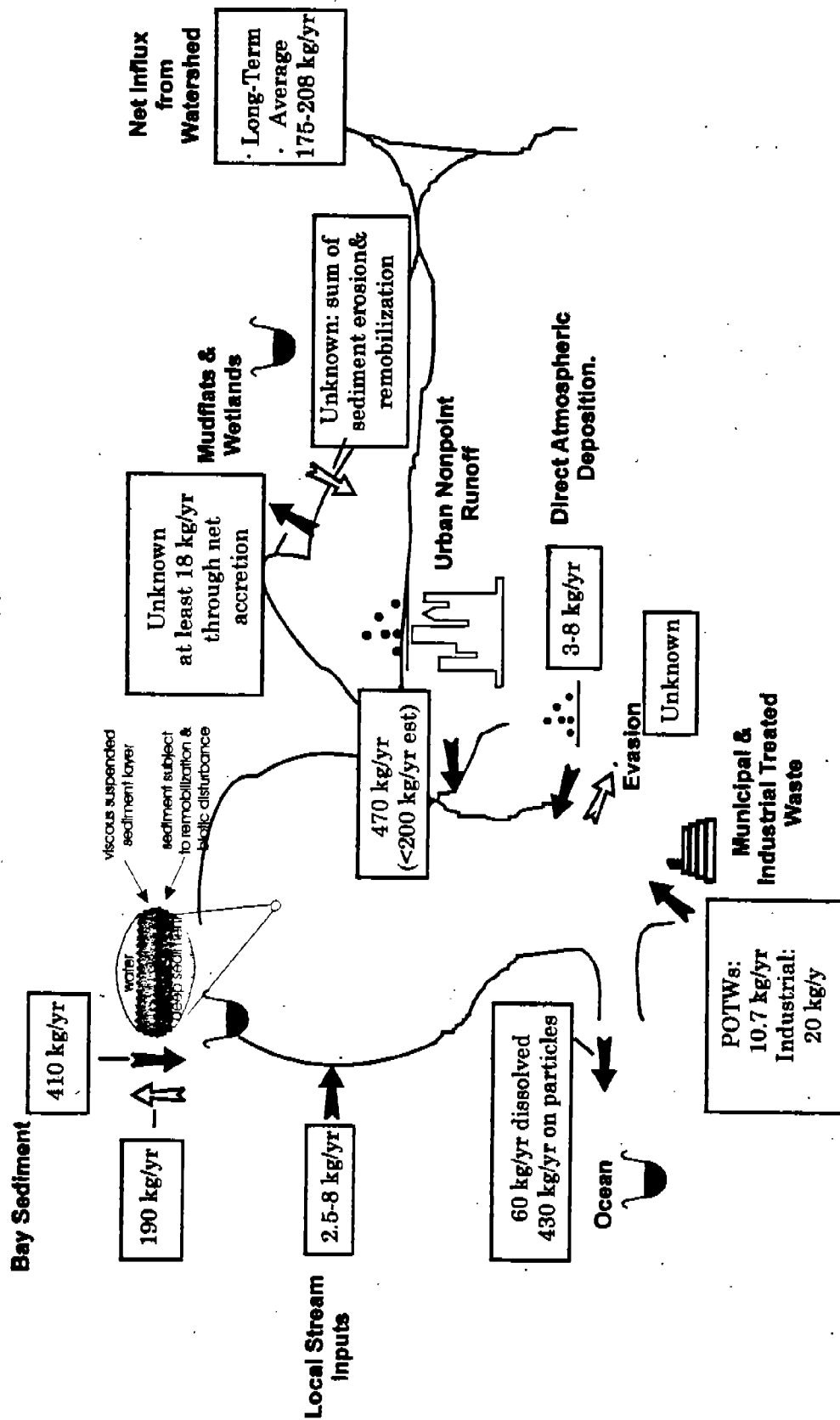


Figure 1. Mercury Budget for the Northern Embayments

C. Conceptual Models of Mercury Inputs, Fate, Transport, and Bioaccumulation Pathways

Inputs of mercury to the aquatic system alone do not determine where, and to what extent beneficial uses are at risk due to accumulation of mercury in the food chain. Methyl mercury (CH_3Hg^+), by far the most bioavailable form and the key chemical species of concern, is formed primarily in sediment systems where sulfate-reducing bacteria are present. Methyl mercury, however, can also be formed in the water column and through chemical as well as biological processes. The rate at which methyl mercury is formed in the watershed, and the location where this transformation takes place is the key factor in determining the extent to which beneficial uses are affected.

To understand methyl mercury formation, it is also necessary to understand how the total stock of mercury in a watershed enters, moves through, and leaves the aquatic system—as well as how the prevalent chemical forms are transformed into bioavailable methyl mercury. Figure 2 describes the conceptual model staff have developed that captures the key elements of these processes.

Because the vast majority of mercury in a watershed is associated with sediment particles, fluxes of mercury through a watershed system are largely governed by sediment transport processes. However, the chemical form of mercury is not the same from particle to particle. The four boxes in Figure 2 represent stocks of different kinds of mercury. As you move down the watershed, sediments are eroded, transported down stream systems by flood waters, then settle out in flood plains, riparian wetlands, or other low-energy areas. Later floods start the cycle again, only further downstream. Each time a particle moves to a new location in the stream system, it is subject to new environmental conditions. In places where bacteria thrive, like wetlands or shallow/turbid areas with ample organic material, the mercury on particles can be chemically and biologically transformed. Watershed transformations are cumulative, and slowly change the mixture of inorganic mercury moving down river, increasing the percentage that is easily methylated.

Inputs of mercury are also labeled in Figure 2. Much of the native mercury in geological formations and some mine sites enters the watershed as mineral forms; watershed processes gradually transform some of the mineral into more readily bioavailable forms, creating a natural baseline level of mercury in the food chain. Human activities, including global fossil fuel combustion and local mining and mercury use, have tended to add “reactive” forms of inorganic mercury to the mineral forms already present in the watershed. The cumulative effect of human activities has thus not only added more easily methylable mercury, but increased the rate and total mass loading to aquatic systems. For example in Figure 2, atmospheric deposition and the use of elemental mercury in gold processing adds inorganic forms of mercury that are more easily transformed than mineral forms. Treatment plant effluent, regardless of waste type, adds dissolved mercury to the mixture.

The final key element in Figure 2 is that geography matters. Inputs of mineral mercury at the bottom of a watershed are of much less concern than inputs of dissolved mercury into subenvironments where methylating bacteria thrive. Conversely, the risk of bioaccumulation in any reach in the upper watershed depends on a different balance of factors than the net bioaccumulation at the bottom of the watershed.

Key Mercury Flux and Transformation Processes

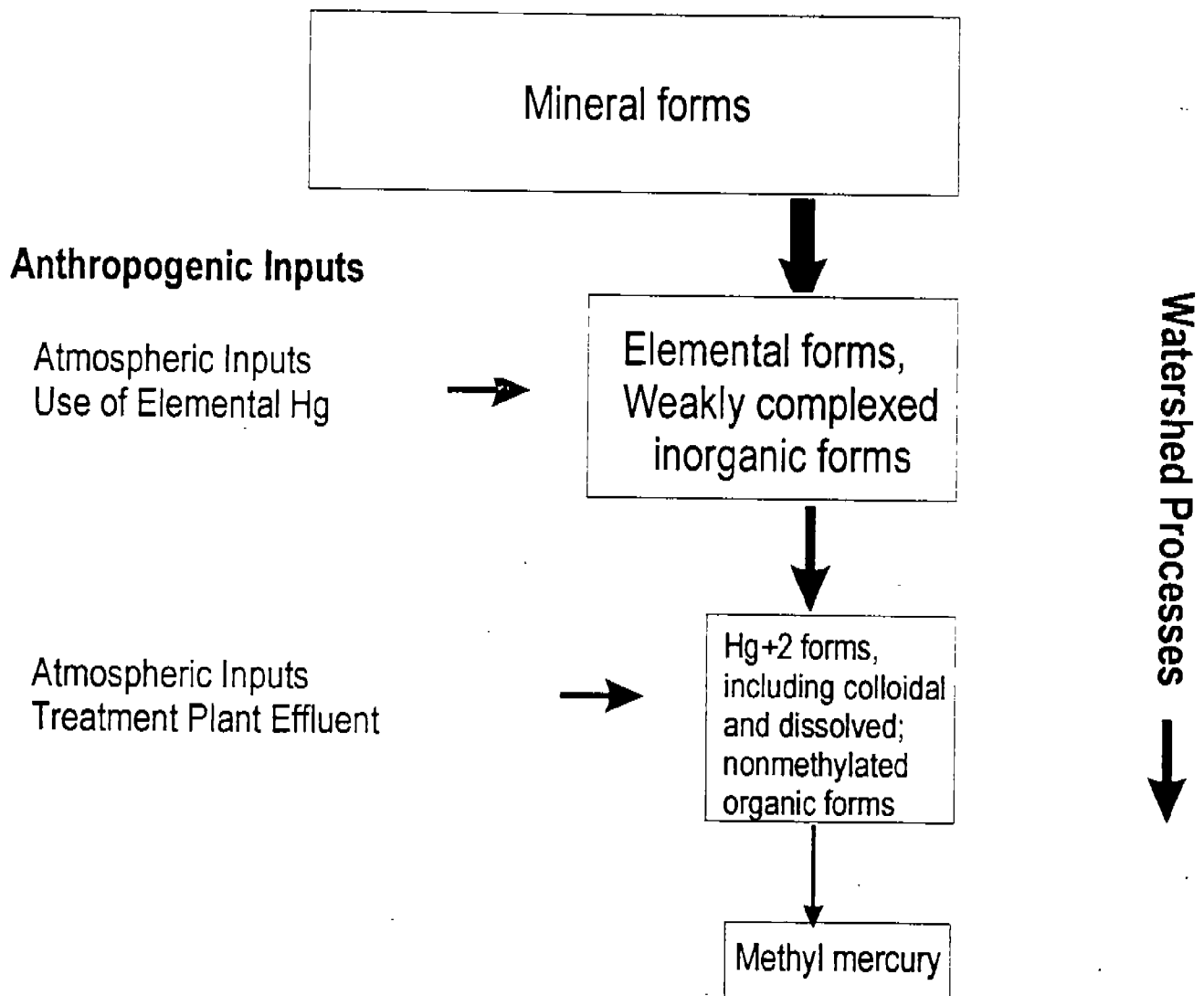


Figure 2. Key Mercury Flux and Transformation Processes

The conceptual model in Figure 2 provides a simple framework for determining the relative risk of different sources of mercury, and the processes that need further characterization in order to fully predict changes in environmental levels of mercury due to changes in inputs and watershed processes.

D. Status of Current Regulatory Programs

The Regional Board currently has several regulatory programs and policies aimed at reducing the loading of pollutants like mercury into the Bay system and achieving full protection of beneficial uses within the Region. The three main program areas are waste discharge permits for point sources (including stormwater), pollution prevention programmatic requirements, and contaminated site cleanup and remediation (including mines). For this analysis, staff reviewed each program area to determine whether existing policies, guidelines, and procedures were appropriately addressing the mercury problem. We found that:

- Several changes need to be made in the way point source treatment plant permit limits are developed for mercury;
- Many of the local sewer district pollution prevention programs are successful and these successes should be communicated to all sewer districts and comparable levels of effort expended to achieve load reductions;
- Urban stormwater monitoring programs have not yet focused on mercury sources for BMP development but we expect that the bulk of loading from these systems is due to atmospheric deposition;
- All dischargers and monitoring efforts should use ultra-clean sampling and analytical techniques to characterize fluxes and loadings. These data will be used to confirm effluent quality attainable through pollution prevention and to confirm the atmospheric deposition hypothesis;
- Mine and contaminated site remediation projects within the Region are generally proceeding at a reasonable pace but abandoned mine remediation further up the watershed has stalled due to financial and legal constraints;
- Regional technical studies need to be done to shed light on how classes of activities (i.e., wetland management and stormwater retention basins) may affect the net rate of methylation in the Bay system.

We reached these conclusions by conducting an intensive review of treatment plant discharge data. All wastewater treatment plants in the Region currently have water quality-based effluent limits for mercury. These are derived according to the general provisions in the Basin Plan and site-specific conditions as determined by individual permit writers on a case-by-case basis. In general, shallow water dischargers must currently meet either 0.025 ppb or 0.012 ppb total mercury at the discharge point; deep water dischargers must meet either 0.25 ppb or 0.12 ppb total mercury. These effluent limits follow the standard template for deriving a maximum water column concentration that is protective of beneficial uses such that receiving waters beyond an

initial mixing zone do not exceed this concentration. In the case of mercury, however, beneficial uses are not threatened by water column concentrations, but by system-wide bioaccumulation.

Staff conducted a detailed analysis of treatment plant self-monitoring data to determine mercury mass loading patterns from these sources. Three years of data from all plants discharging to the northern embayments (north of Angel Island in Central Bay) show that:

- concentration-based effluent limits (set at maximum concentrations) do not provide the appropriate link between potential mercury bioaccumulation and discharge;
- there are widespread compliance problems associated with water quality-based effluent limits derived using the standard template;
- allowable mercury inputs are unevenly distributed between shallow and deep water dischargers;
- conventional analytical techniques (and most self-monitoring data) significantly overstate mercury concentrations and loadings from treatment plant effluents.

Staff reviewed the status of pollution prevention programs by gathering reports and audits compiled by sewer districts within the Region and across the country. These reports indicate that:

- controllable inputs generally represent less than 25% of the total mercury entering treatment plants;
- the most significant loading reductions reported for pollution prevention programs occur in cases where there is a single dominant source to a treatment system (i.e. a chlor-alkalai plant) and that source can be reduced through production substitution;
- best management practices that prevent mercury from entering sewer systems, using dry waste disposal, screens, gravity traps, and proper pipe maintenance are cost effective and can significantly reduce controllable inputs; and
- residential and commercial laundries (bleach and dye impurities) and thermometers represent significant fractions of treatment plant inputs and are probably best addressed through product substitution.

During this review, staff also found that the largest sewer districts within the Region have already implemented local pollution prevention measures, although further work to ensure that successful measures are communicated to smaller districts is probably necessary. Aside from ensuring consistency in the level of effort, the Board's programmatic pollution prevention requirements are currently being met. Beyond the BMPs outlined above, further reductions in mercury inputs to treatment plants are probably not practicable in the short-term.

The Regional Board regulates waste discharge from mine sites and staff have been actively involved in ensuring full remediation of all mines posing water quality threats in the Region for several decades. The result of this work is that most of the major mines sites, including those associated with mercury, are currently under cleanup orders. Cleanup of the largest mercury mine, New Almaden, a Superfund site, is ongoing; the status of this cleanup is included in Appendix A.

Site characterization work is currently underway for the Gambonini mine on Walker Creek (Tomales Bay), and staff have recently completed site inspections of all known mine sites in the Region. Those inspections indicate that there are at most two or three mine sites in the Region where mercury may be a slight problem and no site characterization has yet begun.

Mine remediation involves very different approaches than control of mercury inputs from treatment plants or through pollution prevention strategies. Successful remediation hinges partially on extremely thorough site characterization, but also on best professional judgment. The extent of reductions in mercury loading can be estimated before remediation, but is generally not possible to quantify with any degree of accuracy. In addition, the accuracy of estimates varies dramatically from site to site. The regulatory oversight of mine remediation typically specifies the scope and level of detail of site characterization, specific remedial actions, follow-up monitoring to test the effectiveness of those actions, and a general requirement for further action if the follow-up monitoring indicates incomplete work.

While cleanup of the largest mine sites in the Region is underway, mine remediation of new sites in California is virtually at a standstill because of the potential liability to parties or agencies involved in remediation of a site. Under current federal law, a party who engages in cleaning up *some* of an environmental hazard on an abandoned mine site can become liable for removing all of that hazard even if that party had no prior association with the property. This dilemma is commonly referred to as the "good Samaritan" problem. The problem is rooted in how the Clean Water Act and CERCLA laws identify a responsible party (PRP) and their long-term liability for the site. In establishing legal responsibility, the courts use the concepts of "strict" liability and "joint and several" liability. Strict liability means that individuals can be held liable even if negligence is not proven. Joint and several liability means that a single party found liable for damages can be held responsible for all associated costs even if that party's actual contribution to the damages is minimal. The use of such stringent liability standards was intended to save the government from the costly and time-intensive process of proving negligence and in the case of Superfund sites, from determining what portion of remediation costs each PRP must pay. There was also an expectation that the use of joint and several liability would encourage an identified PRP to name all other responsible parties at a given site. Unfortunately, legislators did not make any special liability provisions for voluntary site remediation work where volunteers had no prior association with the site, or for cases where the general public becomes liable for remediation of abandoned sites. The absence of such provisions in federal law presents a major disincentive for environmentally concerned groups to engage in volunteer cleanup work, particularly at abandoned sites. State laws have been amended to provide for good Samaritan mine remediation work. Despite the procedural obstacles standing in the way of reducing inputs from mines, remediation of obvious, large mine sources appears to be the single largest, cost-effective approach to reduce ongoing inputs.

Because several changes in the current approach for regulating mercury inputs to the Bay watershed are warranted, staff expanded the analysis to include a review aimed at identifying cost effective control measures.

E. Potential Control Measures and Costs to Reduce Ongoing Inputs

The conceptual model for mercury fate and transport in the Bay system presented above encapsulates the current state of knowledge about how ongoing and historical inputs relate to

observed bioaccumulation. However, many factors can not be quantified at this time and there are uncertainties about how much controllable factors, if controlled, can achieve measurable reductions in the net production of methyl mercury in the system and over what time frame these changes are likely to take place. Controllable factors are “those actions, conditions, or circumstances resulting from human activities that may influence the quality of the waters of the state and that may be reasonably controlled.”

We elected to include a detailed analysis of potential control measures in this staff report because of these uncertainties and to provide the basic information to determine whether the following provisions of the Basin Plan are applicable to mercury bioaccumulation in San Francisco Bay:

When uncontrollable water quality factors result in the degradation of water quality beyond the levels or limits established herein as water quality objectives, the Regional Board will conduct a case-by-case analysis of the benefits and costs of preventing further degradation. In cases where this analysis indicates that beneficial uses will be adversely impacted by allowing further degradation, then the Regional Board will not allow controllable water quality factors to cause any further degradation of water quality (p.3-1, Water Quality Control Plan)

Potential control measures were identified through an extensive set of interviews, literature searches, and technology reviews, many of which were prepared by consultants for the types of facilities/sites described in this report. The potential control measures listed here, along with ballpark cost estimates for general types of facilities, are those technologies and BMPs that are currently available and most likely to be implemented. High-end and experimental technologies, such as reverse osmosis are not included.² Table 1 summarizes the results of this review.

In Table 1, sludge incinerators were identified as one of the local, major sources to the atmosphere. As with fossil fuel combustion, trace levels of mercury in sludge and other wastes can be significant local atmospheric sources. Typically, these local air sources can be controlled with equipment designed to increase particle removal. It is unknown, however, what fraction of local air deposition is due to local air releases—Bay Area mercury probably travels towards the Sierra and is deposited in the upper reaches of the Sacramento watershed or further east.

The combination of pollution prevention programs and specific BMP measures that these programs require are probably the most cost effective approaches for controlling mercury discharges from treatment plants. End-of-the-pipe technologies are both orders of magnitude more expensive and of an unknown reliability. Because low detection limit monitoring data are not available for industrial or stormwater discharges, it is not possible to determine whether similar measures are possible for these systems as well. Mass loading to the Bay from urban runoff, however, could theoretically be controlled with settling basins or polishing wetlands—these techniques can easily backfire, however, because they may serve to transform inorganic mercury in stormwater runoff into bioavailable methyl mercury. While we are not advocating use of these

² A note to parties intending to comment on the issue of cost: the most useful information about cost of control measures includes data for *classes* of facilities and control options. In addition, cost information for specific facilities should be documented and, if possible, set in the context of comparable information from other facilities.

systems, the cost (much higher than pollution prevention) is included for comparative purposes. Finally, a ballpark estimate for mine remediation costs was also developed. Because some of these sites are concentrated sources, rather than the cumulative loading from extremely diffuse, multi-party activities, it is reasonable that the overall remediation cost is less for abandoned mines—even given the technical and procedural difficulties associated with remediation.

Source	Description	Annual Cost (\$)	Est. Load Reduction (g/year)	Avg. Cost (\$/g)
Sludge Incinerators	modifications of wet scrubber system	120,000 ¹	36 ²	3,300
POTW	source control program	200,000 ³	90 ⁴	
Indirect dischargers subject to source control:				
dentists	gravity traps	2,500 ⁵	incl. above	
hospitals	see text	10,000 ⁶	incl. above	
labs	see text	5,000 ⁷	incl. above	
product subst.		0	incl. above	
laundries	POTW + indirect	265,000	90	3,000
Total costs	discharger BMP			
Direct industrial discharges	?	?	?	?
Urban runoff	?	?	?	>3,500 ⁸
Abandoned mines	reclamation	150,000 ⁹	1,400 ¹⁰	1,100

Notes:

¹ Based on \$1 million capital cost amortized over 20 years @ 8% = \$100,000 plus \$20,00/year increase in operations and maintenance

² Based on an estimated 10% decrease below average north Bay POTW annual mass loading of 360 grams

³ Based on program cost estimates provided by San Francisco and Western Lake Superior Sanitation Dist.

⁴ Based on an estimated 25% decrease below average north Bay POTW annual mass loading of 360 grams

⁵ Total cost and load reductions based on theoretical community served by average north Bay POTW with 10 dental offices

⁶ Total cost and load reductions based on theoretical community served by average north Bay POTW with 2 hospitals

⁷ Total cost and load reductions based on theoretical community served by average north Bay POTW with 4 labs

⁸ Total cost and load reductions based on theoretical community served by average north Bay POTW with 4 commercial laundries

⁹ Based on \$1 million in reclamation costs amortized over 20 years at 8% = \$100,000 and \$50,000 per year in monitoring studies and maintenance

¹⁰ Based on characterization of Mt. Diablo mine on Marsh Creek (eastern Contra Costa County) with estimated wet flow loading to Marsh Creek of 28g/day over 100 wet flow days and assuming 50% reduction of loadings to creek due to remediation work (figures based on site characterization—CCC, 1996).

Table 1. Cost Information on Potential Mercury Control Measures

F. Design of Proposed Regulatory Policy and Program Elements

In the spring of 1997, an internal mercury task force was set up at the Regional Board. Members of this task force investigated the environmental and permitting aspects of mercury regulation and developed several solution criteria that any new or alternative regulatory approaches should meet. These criteria served as design parameters for the proposed policy options in this report.

The general environmental solution criteria are that regional policies and regulatory control measures should reflect the following:

- The most affected beneficial use is fishing; in particular, fishing that involves consumption of long-lived fish species at the top of the aquatic food chain. It is also likely that wildlife uses are similarly affected;
- Mercury bioaccumulation is likely to be highest in wetland subenvironments; levels of mercury in these environments should reflect the combination of natural methylation and increases in net methylation due to historic and ongoing anthropogenic activities;
- Mercury flows, fate, and transport are governed by sediment fluxes;
- Additions to, decreases in, and fluxes into wetland habitats are the most likely factors that will control the rate of methyl mercury production in the watershed;
- All ongoing inputs of mercury have the potential to be converted into methyl mercury, but dissolved and colloidal forms typically discharged from treatment systems are far more bioavailable than mineral forms;
- Both historic and ongoing inputs affect the net stock of methyl mercury in the system;
- Ideally, ongoing inputs should be less than natural removal of mercury to deep sediments, nonerosive wetlands, and to the ocean (i.e. inflow is less than outflow).

In addition to the environmental criteria outlined above, the internal task force also recommended a number of social criteria that proposed regulatory policies should also meet. These social criteria are:

- A regional regulatory policy for mercury should be structured so as to bring the Bay system into compliance with the narrative water quality objectives or the antidegradation policy while also taking into account historical loadings to the system;
- Regulatory requirements should emphasize the largest, ongoing sources of mercury to the Bay system;
- Regulatory requirements should implement the general requirement in Porter Cologne to “control controllable sources” and the Basin Plan provision on p. 3-1 in a consistent manner within and between all pollutant control programs (i.e., POTW source control, nonpoint source BMPs, direct discharger treatment requirements, and “hot spot” cleanup);
- Use of dilution credits for bioaccumulative substances should be fair and consistent;

- Water quality based effluent limits for mercury should be designed to hold all parties to an equal level of responsibility;
- Solutions must fit into the constraints and direction of all relevant laws and regulation;
- Effluent limits and permit conditions must reflect the fact that water column toxicity **is not** an environmental concern and that downstream bioaccumulation is an environmental concern.

An ideal regulatory approach for mercury in the Bay system would fully meet all of the solution criteria.

We have reviewed a number of different administrative approaches and, for some, developed a full range of proposed policy and regulatory program elements for public review and Board consideration. The administrative approaches considered were:

- Develop a site-specific objective for mercury that better reflect local conditions and environmental risks;
- Outline an acceptable approach by which point source dischargers could determine and apply for alternate limits;
- Develop a full-fledged Total Maximum Daily Load (TMDL) for mercury for the Sacramento River-San Francisco Bay watershed; and
- Develop a pilot mass-based permit offset system to direct regulatory attention towards the most cost-effective loading reduction measures.

For a variety of reasons, staff chose the last two approaches, namely development of a watershed-based regional policy and regulatory approach equivalent to a phased TMDL and an offset system. The proposed elements of this policy and set of implementation provisions are designed as amendments to the Basin Plan.

G. Proposed Regulatory Policy and Program for Mercury in the San Francisco Bay Region

The proposed elements of this new regional policy and regulatory program were designed using the solution criteria presented above and based on the findings of this study. Specifically, they are designed to ensure that ongoing, controllable mercury loading to the Bay system is low enough to allow the natural cleanup processes to slowly remove mercury from the biological system. The elements are also designed to ensure that this goal is achieved in a fair manner and to facilitate the implementation of the most cost-effective measures first. To do this, staff are proposing the following changes to the current Basin Plan (indicated by redline/strikeout):

Chapter 3:

under *Objectives for Specific Chemical Constituents*, p. 3-5:

The Regional Board intends to work towards the derivation of site-specific objectives for the Bay-Delta estuarine system. Site-specific objectives to be considered by the Regional Board shall be developed in accordance with the

provisions of the federal Clean Water Act, the State Water Code, State Board water quality control plans, and this Plan. These site-specific objectives will take into consideration factors such as all available scientific information and monitoring data and the latest US EPA guidance, and local environmental conditions and impacts caused by bioaccumulation. Copper, ~~mercury~~, PCBs, and selenium will be the highest priorities in this effort.

[this change indicates that a watershed-based policy and regulatory program will be used instead of a site-specific objective process]

under *Table 3-3 Water Quality Objectives for Toxic Pollutants for Surface Waters With Salinities Greater than 5 ppt*, p. 3-9, add the following footnote to "Mercury":

Extensive monitoring of San Francisco Bay embayments indicates that total mercury concentrations in the saline waters within the Region are highly dependent on suspended sediment concentrations and the factors that control them such as wind, tide, and Delta outflows. The Board will implement this objective for mercury using a watershed-based policy and regulatory program (described in Chapter 4) that takes sediment fluxes and other local factors into account.

under *Table 3-4 Water Quality Objectives for Toxic Pollutants for Surface Waters With Salinities Less Than 5 ppt*, p. 3-9, make the following changes to footnote "I":

The US EPA water quality criterion for mercury which was the basis for the objective in this table, was 0.012 µg/L. At the time this objective was adopted, 0.012 µg/L was below the level of detection. The Board elected to set the numeric objective at the level of detection (0.025 µg/L) at that time, noting that 0.012 µg/L was desirable. Since that time, ultra-clean sampling techniques have considerably lowered the level of detection. Extensive monitoring of San Francisco Bay embayments indicates that total mercury concentrations in the freshwater within the Region are highly dependent on suspended sediment concentrations and the factors that control them such as wind, tides, rainfall, and streamflow. The Board will implement this objective for mercury using a watershed-based policy and regulatory program (described in Chapter 4) that takes sediment fluxes and other local factors into account.

~~The US EPA Water Quality Criterion for mercury is 0.012 µg/L, which is below the level of detection of 0.025 µg/L. An objective of 0.012 µg/L is desirable, but attainment can only be determined at the level of detection.~~

[these changes indicate that the underlying water quality standard will not change (i.e. acceptable fish tissue concentration levels), that the established numeric objective is not necessarily the best indicator of whether the standard is being met, and that implementation of the standard will require a unique set of measures]

Insert a new section following “*Toxic Pollutant Accumulation: Mass-Based Strategies*” on p. 4-2 and before “*Scientific Research: Ongoing Refinement of Programs*” on p. 4-3:

Watershed-Based Policy and Regulatory Program for Mercury in the Central and Northern Reaches of the San Francisco Bay Estuary

The Regional Board will implement the numeric objectives for mercury and the narrative objectives in this Plan by regulating ongoing mercury discharges to Richardson Bay, Central San Francisco Bay, San Pablo, Carquinez Strait, Suisun Bay, and the western segment of the Sacramento-San Joaquin Delta on a watershed, mass loading basis. The objective of this strategy is to reduce mercury loading to a level below the rate at which mercury flows out of the biologically active zones of the Bay system (i.e., all parts except the deep sediment layer). Because of the large sink of historic mercury deposits, it is anticipated that the rate of natural cleanup will take on the order of decades. The goal of the regulatory program is to ensure that natural cleanup will occur, and at the fastest practicable rate. As this process takes place, staff anticipate a gradual decline in fish tissue concentrations. These tissue concentrations should be monitored on a periodic basis to provide feedback on how mercury levels change in the system over time.

The Board will implement this policy by identifying and implementing mercury control measures in the order of cost-effectiveness. Specific categories of control measures that have been identified as the most cost effective means of reducing ongoing loadings are: mercury mine site remediation, gravity traps and drain maintenance in facilities where mercury is commonly used, and product substitution in cases where mercury is an impurity or waste and comprises a significant fraction of inflows to treatment plants. In addition, mercury-specific effluent limits for point sources that will implement this policy, as well as designed to facilitate implementation of cost-effective control measures are described in the section on Effluent Limitations later in this chapter.

In addition to these policy-oriented amendments, we have also developed a number of specific implementation proposals to ensure that permitting practices fully implement the proposed policy. These proposed changes are outlined below. Specific Basin Plan language for different permitting options will be developed following the first round of public review and comment on this watershed analysis.

1. General Permit Conditions

All waste discharge permits that include monitoring provisions for mercury should also require that this monitoring be conducted using ultra-clean sampling and analysis techniques. Much of the data on loadings from large dischargers and stormwater programs indicate extremely high mercury loadings because of poor detection limits.

2. Mass-Based Effluent Limits for Sewage Treatment Plant Discharges

To fully implement a watershed-based program, including an offset option, mass loading limits based on long-term, average loading (rather than instantaneous concentrations) should be used in

discharge permits. Derivation of allowable mass loads is based on the overall mercury budget for the Bay and the review of potential control measures described above. The options and associated allowable loads for each class of discharger are presented below in Table 2. Staff also recommend that concentration limits be maintained in permits at levels that would protect against chronic *toxicity* in the immediate receiving water. As a result, there would be two permit limits, one to protect against near-field water column toxicity and a second aimed at protecting against long-term bioaccumulative effects downstream in the Bay where sediment is deposited and mercury methylation takes place.

We are proposing three options for setting effluent limits for mercury in NPDES discharges located north of the Bay Bridge. Each is expressed in terms of an annual average daily mass loading, but differ in allowed dilution credits and assumptions about the effectiveness of *new* pollution prevention measures and more accurate sampling analyses.

Under option 1 (Table 2), shallow water effluents would be adjusted to better reflect the overall contribution of these sources to ongoing mass loadings and staff's estimate that 0.02 µg/L is achievable with reasonable pollution prevention investments and use of more accurate analytical techniques. In addition, deep water dischargers would be held to slightly more stringent limits. Under option 2, shallow water dischargers would have the limits as under option 1, but deep water dischargers would be required to meet limits that are about 10 times more stringent as they do now. This option is based on the fact that the primary concern about mercury is mass-based, and the solution criteria that sets a requirement for consistency between classes of dischargers. Option 3 includes the same basis as option 2, but reflects a slightly different assumption about attainability of load reductions.

3. Mass-Based Effluent Limits for Industrial Discharges

Staff are also proposing to add mass-based effluent limits for industrial dischargers, using the same calculation methods and options for dilution credits defined above. However, because self-monitoring data submitted by industrial dischargers are not based on ultra-clean analytical techniques, it is impossible to derive a meaningful assessment about current actual loading and whether the mass limits proposed for POTWs are achievable.

We are requesting public comment on options for setting mass limits for industrial dischargers, for substantiated information on achievability of different mass loading levels, and for summaries of pollution prevention audits and measures that have already been taken specific to mercury.

4. Mass-Based Permit Offset System for POTW and Industrial Discharges

Staff recommend that a pilot offset program be launched as part of the proposed regulatory program with the components outlined below. The purpose of a mass-based offset system is to allow permittees the flexibility to implement the most cost-effective control measures in a watershed, rather than forcing point source discharges to install extremely expensive equipment when much larger ongoing sources have yet to be controlled. A pilot, rather than permanent program, is necessary to further develop the necessary administrative tools to ensure long-term success.

	Option 1	Option 2	Option 3	No Change
Assumptions	<ul style="list-style-type: none"> Maintain 10:1 dilution/mixing zone policy Apply policy to mass limits Average effluent concentration of 0.02 µg/L is achievable¹ 	<ul style="list-style-type: none"> Set mass loading policy as equal limits regardless of mixing zone Average effluent concentration of 0.02 µg/L is achievable¹ 	<ul style="list-style-type: none"> Set mass loading policy as equal limits regardless of mixing zone Average effluent concentration of 0.05 µg/L is achievable¹ 	<ul style="list-style-type: none"> Maintain 10:1 dilution/mixing zone policy Effluent limits set in terms of concentration as per equation in Basin Plan;²
Loads				
Shallow Water				
Dischargers				
current load ³	9.43	9.43	9.43	9.43
allowed load ³	2.78	2.78	6.96	1.67
difference	+6.14 ⁴	+6.14	+3.83	+7.06
Deep Water				
Dischargers				
current load ³	28.54	28.54	28.54	28.54
allowed load ³	65.8	7.28	18.2	70.25
difference	-37.26 ⁴	-21.26	-10.34	-41.70
Total Allowed Load³	68.58	10.06	25.16	71.92
Change in Total Allowed Load³	-3.34	-61.86	-46.76	0

Notes:

¹ Achievable was determined based on past performance, pollution prevention reductions, and improved quantification of mercury at a number of POTWs within the Region. This represents a long-term average concentrations, not instantaneous maximums.

² The current allowable loads were calculated assuming effluent limits for shallow water dischargers of 0.012 µg/L (all are freshwater) and for deep water dischargers of 0.214 µg/L with 10:1 dilution credits (except for DDSD—a deep water discharger to freshwater assumed to have limits of 0.048 µg/L).

³ Load values are annual average grams per day.

⁴ Positive differences reflect loads above allowable levels; negative differences reflect compliance.

Table 2. Proposed Effluent Limits for POTWs

Staff recommend the following components of a mercury mass offset pilot program:

- The pilot program should be in effect for 7 years (to allow for a significant fraction of NPDES permit terms);
- The goals of the pilot program are to:
 - define legally binding remediation contracts for each specific project containing the offset program member's or members' financial commitments (more than one program participant may contribute towards remediation of the same site); specific remediation tasks to be completed at the site and subsequent monitoring efforts; and obligations and responsibilities of all private and governmental parties necessary to ensure the adequate completion of remediation and monitoring tasks;
 - determine whether a permanent offset system will successfully control ongoing inputs of mercury to the watershed;
 - and reduce overall mercury loadings during the term of the pilot program.
- The top priority for remediation projects funded through an offset program are those sites where cleanup is, for all practical purposes, a public responsibility. Sites where responsible parties exist who are able to undertake remediation are of a lower priority;
- It is desirable that site characterization and remediation plans be developed before a site is eligible for inclusion in the pilot program. However, because the cost of these plans is a legitimate part of control of ongoing sources, the pilot program may undertake to conduct this work if no appropriate sites are ready for remediation;
- Language will be added to the permits of entities participating in the pilot program to the effect that: "Effective annual average mass loadings must be less than or equal to the annual mass limits specified in this permit. The effective annual average mass loadings equal actual mass loadings less any mass credits purchased through the pilot offset credit program."
- Permit offset ratios for the pilot program are 1 unit in effluent : 3 units as projected by site characterization and remediation plans;
- The Executive Officer would approve mass credits for each participant. The mass credits would specify the total amount of mercury load considered removed from ongoing inputs to the watershed, and the number of years that load reduction would be spread across mass loading requirements in NPDES permits. For example, Discharger A applies to remediate 1 kg of mercury by diverting water around a tailings pile at an abandoned mine site and requests that the 1 kg be applied as 200 g credits in each year of the five-year NPDES permit. After review of the proposed remediation and legal agreements, the Executive Officer could approve this offset. Should the remediation not be completed as specified in tasks outlined in remediation plans, the Board can initiate enforcement proceedings against the party responsible for carrying out the remediation.

We are seeking comments on the proposed pilot offset program and the basic operating principles outlined above. It should be emphasized that the proposal is for the design and testing of a **pilot** program, and not a final system.

5. Permit Conditions for Stormwater Sources

The findings of this analysis indicate that the predominant ongoing source of mercury to stormwater is likely to be atmospheric deposition. The permit conditions appropriate for stormwater dischargers are (a) improved loadings characterization using low detection limits and ultra-clean sampling techniques better characterize loadings and test this working hypothesis, (b) identification of conditions where stormwater flows of mercury may be contributing to the overall flux of mercury into methylating subenvironments, (c) if conditions are identified under (b), identification and implementation of BMPs to minimize methylation.

6. Net Mercury Methylation Rates—Human Influences and Research Priorities

The policy and regulatory program measures outlined above all address overall mercury loadings to the Bay system. Net bioaccumulation, however, also depends on the rate at which stocks of mercury in the Bay are transformed into methyl mercury by bacteria. These processes and the pathways by which particle-bound mercury move into methylating subenvironments are not well-understood.

Based on this watershed analysis, staff believe that the highest research priorities for mercury are the following:

- characterization of the **links** between physical sediment transport processes in the Bay, the overall movement and biogeochemistry of mercury between the main embayments and subenvironments where methylation occurs;
- net methylation rates in these subenvironments;
- food chain bioaccumulation models linked to net methyl mercury production in these subenvironments; and
- identification of human actions that may significantly influence the net transfer of mercury into methylating environments and net methylation rates.

Until information from research outlined above is available, we recommend a basic policy addition to the Basin Plan in a new section on mercury in Chapter 4:

Classes of activities which have been shown to significantly increase the net rate of mercury methylation will be reviewed by the Regional Board under its authority to regulate impacts on aquatic beneficial uses. Whenever possible, these activities should be limited or conducted in a way that will minimize increases in net methyl mercury production.

7. Additional Measures

All of the measures described above are focused on regulatory provisions for discharges to surface water within the San Francisco Bay Region. The nature of the mercury problem, however, is somewhat broader. For example, mercury loading is a significant problem in the Delta and Sacramento watershed, both of which are under the Central Valley Regional Board's jurisdiction. To address these broader issues, staff will draft proposed Board resolutions requesting:

- That the Office of Environmental Health Hazard Assessment conduct (or publish existing) reviews of mercury consumption rates and doses to consumers of Bay fish, specifically comparing mercury levels in Bay fish to levels in fish from other areas, identifying the subpopulation at the greatest risk due to consumption of local fish, and development of a risk communication strategy to mitigate the risk posed to the identified subpopulation;
- Coordination with the Central Valley Regional Board to identify and remediate abandoned mercury mines in the Sacramento River watershed, make the proposed pilot program available to discharges in the Central Valley Region, and to discuss consistency between regulatory programs; and
- Coordination with the Bay Area Air Quality Management District regarding local, stationary sources of atmospheric mercury and water quality impacts associated with those sources.

8. Intermediate-Term Measures

The elements of the proposed watershed-based mercury program include a list of immediate actions and long-term goals. It is also appropriate to identify intermediate-term research needs and analyses that will serve as an ongoing check on the overall program. They are as follows:

- Test numeric targets for mercury concentrations in fish tissue, suspended sediment particles, and dissolved water column levels against local technical data to determine if these targets would serve as appropriate indicators of system-wide changes;
- Encourage research on understanding net methylation rates;
- Encourage research on understanding of system inflows, outflows, and methylation potential; and
- Track changes in fish tissue concentrations at expected rate of change.

When this technical information becomes available, the mercury budget model, permitted mass loads, and pilot offset program goals, and the existing water quality objectives can be revisited and, if appropriate, revised in light of the new information.

H. TMDL Summary

Together, the proposed regional policy and program elements comprise a TMDL for mercury as defined under the Clean Water Act and in federal regulations. Under federal law, a TMDL is required for specific water bodies when they fail to meet water quality standards and local control programs are not sufficient to bring the water body into compliance. Because numeric and

narrative objectives for mercury are being exceeded, the Regional Board is obliged to develop a regulatory strategy that will ultimately result in compliance. The following is a summary of how the program elements correspond to TMDL elements.

Problem Statement

The problem statement consists of sections I.A.1-2, “Environmental Conditions and Concerns” in the Executive Summary.

Numerical and Qualitative Targets

A numerical target that will represent water quality when a specific water body is in compliance with standards is required as part of a TMDL. Because of the problems associated with the use of water column concentrations as indicators of mercury-related impairment (both dissolved and total) discussed in detail in section II.2, we are defining the numerical target at 1.0 ppm wet weight in shark. This numerical target has been previously established as part of the existing Basin Plan water quality objectives for fresh and salt water. Meeting the target thus automatically ensures meeting the standard.

Two additional targets will be established if these proposed policies are adopted that will, over time, cause the first target to be met. Neither one, however, can be quantified at this time. The first qualitative target is for the rate of ongoing inputs of mercury to be controlled to a point where they are less than the rate of outflow of mercury from the biologically active part of the Bay system (see section IV). The second qualitative target is for a general avoidance of human activities that significantly contribute to the net methylation of mercury already in the Bay system (section VII.C.h). A precise definition of classes of activities and the effects these activities have on mercury methylation will require a significant amount of original research and at least five years to carry it out. However, the proposed amendments contain a policy for avoidance, minimization, and mitigation of classes of activities when this information becomes available. Thus, the regulatory direction can be established now.

We anticipate that it will take several decades for the historical sink of mercury in the Bay to be buried in deep sediments or flushed out and for fish tissue levels to change. During that period of time, the numerical target of mercury levels in fish tissue defined above may change based on a revision of health effects thresholds or through a more complete and thorough analysis of global fish tissue concentrations. If the current local water quality objective is changed in the future through a standard setting process, the success and appropriateness of this TMDL will be reevaluated using the new standard.

Sources Causing Impairment

A thorough assessment of existing stocks and ongoing loadings of mercury to the Bay system is presented in sections II.B. The mechanisms by which these sources of mercury contribute to the defined bioaccumulation problem are described in detail in section III. The general conclusion of these technical reviews is that *all* contributions to the total stock of mercury in the Bay are linked to the observed bioaccumulation problem. The link between the stock of inorganic mercury and the process and rate of methylation that converts that inorganic stock can not be modeled at this

time. Because the total stock of mercury in the Bay is a controlling factor for net methylation, it is appropriate to regulate the inputs of all chemical forms of mercury entering the watershed to achieve the long-term goal.

The largest sources of mercury to the Bay aquatic system are sediments contaminated by historic mining. These sediments include material flushed down local and Sacramento River watersheds during the Gold Rush, and material contaminated in the past by mining that still flows into the Bay with riverine inputs. Gold Rush-era sediments re-enter the biologically active zone of San Francisco Bay through wind, flow, and tide-driven forces. These mixing processes can not be controlled, nor can the diffuse, buried mercury-enriched layer of sediment be removed. Of the ongoing inflows of sediment contaminated during the mining area, only inputs from concentrated mining areas still draining into the watershed are controllable. Attempts to remove diffuse layers from riverine and riparian areas would cause extensive habitat damage, require a significant number of new landfills, and consume large amounts of energy.

A number of sources of mercury make up the remainder of the ongoing inputs to the Bay system. Combined, these remaining inputs are at least one order of magnitude lower than the major sources described above.

By far the largest of these secondary sources is atmospheric deposition (this accounting includes estimated loads from urban runoff). Virtually all of the mercury deposited via atmospheric processes in the Bay area is due to global fuel consumption superimposed on preindustrial background levels of mercury. A small fraction of this load is associated with local fuel consumption and incineration.

The remaining secondary sources are inputs from regulated treatment plants. This report contains an extensive review of mercury inputs to these treatment plants (section VI). The uncontrollable inputs to treatment plants include intake water,³ and human waste. The controllable inputs from these sources include:

- Product substitution/ manufacturing changes for common consumer products (such as reducing trace levels of mercury in laundry bleach and home use thermometers);
- Improved material handling and waste minimization at facilities and locations where mercury is used in a raw material (such as installation of gravity traps in dental offices, proper drain maintenance in hospitals, and collection of metallic mercury still used in small-scale gold mining); and
- Removal of mercury seals in trickling filters used in treatment plants

History of Control Measures Already Taken and Currently Underway

It is important to note that the Regional Board has instituted a number of control requirements before preparing this TMDL. In addition, local agencies have also initiated changes in treatment

³ Even high quality water from San Francisco's Hetch Hetchy system contributes up to 1/3 of the inputs to treatment plants.

plant operation and facilities, and actions within their pollution control programs. In general, the controls have already successfully reduced the amount of ongoing inputs of mercury to the Bay system. If adopted, this TMDL will refine, not initiate, a series of regulatory controls.

A thorough review of the current status of actions that have been taken to control mercury inputs is described in detail in section V. Many of the local districts have already implemented the pollution prevention measures outlined above; all trickling filter seals have been removed. At some facilities, detailed mercury mass balances have been conducted using ultra clean sampling and analytical techniques. In summary, there is a need for a consistent level of effort amongst all pollution prevention programs, but the conclusion of this review is that the maximum amount of total load reductions from treatment plants in the Region is less than 25% of current loads—with smaller reductions possible for systems that have already implemented strict pollution control measures.

In addition, mine remediation activities have already been initiated at most of the mines in the Region (see Appendix A). Accelerated cleanup at the New Almaden Superfund site in the South Bay, and work at some of the smaller mines would serve to reduce ongoing inputs.

Load and Wasteload Allocation Methodology

The Clean Water Act requires that TMDLs contain load allocations for all point source discharges and wasteload allocations for all nonpoint source dischargers. These allocations effectively assign responsibility for remediating the water quality problem. Because of the large contribution of historic practices to the current water quality problem, and because complex sediment dynamic processes govern how much mercury is in the Bay's biologically active zone at any one time, staff have concluded that the most appropriate method for allocating loads is to focus on allocating the responsibility for load *reductions* among classes of controllable, ongoing inputs.

This approach effectively defines the following wasteload allocations:

- Natural background – wasteload allocation set at current levels
- Historic deposit of mercury contaminated sediments – wasteload allocation set at current levels
- Atmospheric deposition – wasteload allocation set at current levels minus very small amount of potential decrease associated with installation of scrubbers on local sewage sludge incinerators (currently under way)
- Local stream inputs (with San Francisco Bay Region) – wasteload allocation set at current levels minus the decrease that will occur as the remaining small upstream mines are remediated
- Sacramento River watershed – wasteload allocation set at current levels *minus*
 - Inputs from ongoing gold mining activities
 - Inputs from mining sites where mercury exists in a concentrated source and effective remediation is practicable
 - Downstream transport of mercury from identified hot spots in the river system

Proposed load allocations based on the review of sources are presented in section VII.C.2. These effectively quantify allowable loads at levels that are achievable with strict pollution prevention programs. Because stormwater loading studies did not use ultraclean sampling techniques, a quantitative allocation of loads from these sources is not possible at this time. However, existing stormwater BMP requirements, combined with the proposed policy for regulating actions that contribute to methylation rates will effectively impose the same pollution prevention requirements on stormwater discharges as are being proposed for treatment plant discharges.

Performance Measures and Feedback

A program is already in place to conduct ongoing monitoring of the Bay environment for the purposes of gauging the effectiveness of regulatory actions and tracking long-term trends of trace substances in the San Francisco Bay Estuary—the Regional Monitoring Program. This program (or comparable study) is specified as a permit requirement for all NPDES permit holders.

The Regional Monitoring Program began the process of monitoring fish tissue for mercury and a number of other pollutants in 1993. Currently, a periodic sampling of a broad array of fish, including those typically caught by local fisherpeople, is being designed and field tested. We expect that fish tissue monitoring will be conducted once every three years for the purpose of tracking long-term trends.

Analysis of the RMP data and review of the regulatory approaches is already established as a regular task. The Regional Board reviews new data and its regulatory approaches through the Triennial Review/ Continuing Planning process. If adopted, this TMDL will be no exception.

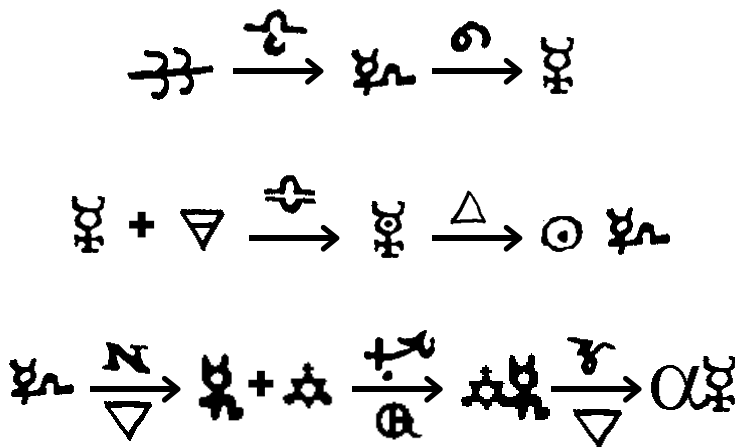
Managing Inactive Mercury Mine Sites in the San Francisco Bay Region

Status report on implementation of the Basin Plan Mines Program

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1. Introduction

This report has been prepared in support of the development and adoption of a total maximum daily load (TMDL) for mercury in San Francisco Bay. California produced significant amounts of mercury from coast range mines during and after the gold rush. Many of these mine sites are located within the San Francisco Bay Region, including the New Almaden Mercury mine, which was at one time the largest producer of mercury in North America. Production at these sites ranged from a few hundred kilograms to more than 35 million kilograms of mercury produced at the New Almaden mines.

While mercury is no longer actively mined in the Bay Area, waste produced from these mining operations persists at the some of the sites, potentially affecting downstream water quality. The objectives of this report are to:

- 1) Summarize known mine sites, including their current status with respect to compliance with the existing Mines Program in the Basin Plan;
- 2) Describe an approach to assessing and managing impacts from known mine sites; and
- 3) Summarize options for remediating mine sites found to be significant sources.

2. The Basin Plan Mines Program

2.1 Framework

The San Francisco Bay Region's Water Quality Control Plan (the Basin Plan) contains a section in the Implementation Plan describing the Regional Board's program for managing active an inactive mining operations (pages 4-47 – 4-49). The goal of the Mines Program is to "restore and protect beneficial uses of receiving waters now impaired or threatened with impairment resulting from past or present mining activities."

Inactive sites are managed by identifying Best Management Practices necessary to protect water quality. The U.S. Natural Resource Conservation Service (NRCS) has developed a Resource Management System for Surface Mined Areas which references practices and treatment systems that address the following elements:

- 1) Erosion Control Practices that will dispose of surface water runoff at non-erosive velocities and reduce soil movement by wind and water to within acceptable limits;
- 2) Maintenance of adequate water quality and quantity for planned uses and to meet

- federal, state and local requirements;
- 3) Pollution control to meet federal, state, and local regulations; and
- 4) A system of planned access and / or conveyance that is within local regulations and meets the needs for the intended use.

Best management practices (BMPs) at inactive mine sites include diverting stormwater runoff around contaminated areas, re-grading, capping, and re-vegetating exposed soil with elevated mercury concentrations, and other measures necessary to reduce erosive discharge of mercury. Implementation of these practices has resulted in substantial water quality improvements at inactive mercury mine sites such as the Gambonini Mine in Marin County and the New Almaden mine sites in Santa Clara County.

In 1980 the Regional Board negotiated a memorandum of understanding with the Council of Bay Area Resource Conservation Districts. The goal of this MOU was to provide for assessment and monitoring of potential and existing soil erosion-related water quality problems. It was agreed that local units of government should have the lead role in controlling land use activities that cause erosion.

The current framework of the Mines Program is that the Regional Board determines what information is needed to assess the potential for water quality impacts from inactive mine sites. Board staff work cooperatively with landowners, resource conservation districts, and local government agencies to gather the needed information and use it to guide the implementation of best management practices by the landowner or responsible party. In situations where cooperative approaches are not sufficient to protect water quality, the Regional Board has the authority to compel monitoring and BMP implementation through cleanup and abatement orders, waste discharge requirements, conditional waivers of waste discharge requirements, or national pollutant discharge elimination system permits.

2.2 Implementation

Implementation of the Basin Plan mines program for mercury starts with identifying sites where mercury was mined. Then sites should be inspected to assess the potential for water quality impacts and identify any needed BMP's. The Mines Program calls for landowners or responsible parties to develop and implement a Site Closure Plan to address site restoration and long term maintenance and monitoring, and a Site Management Plan to address stormwater runoff and erosion control BMPs.

Substantial progress has been in implementing the mines program. In 1995 the Basin Plan was amended to include a map and table showing the locations of all known mines and mineral production areas (Figure 4-5 and Table 4-16 of the Basin Plan). The locations and site histories of Bay Area mercury mines are shown in Table 1. In 1998 a report was prepared by Regional Board staff summarizing the results of site inspections for mine sites, including mercury mines (Seward, 1998). Based on that report, the condition and management of mercury mines in the Bay Area are summarized in Table 2.

2.3 Next Steps

The “site management tracking” section of Table 2 helps identify next steps in the implementation of the Basin Plan Mines Program. At a minimum, all sites should be completed through steps A – F (the shaded area in Table 2). The process of inspecting sites, identifying and contacting owners, notifying local agencies, and conducting load and risk assessments can very likely be completed through non-regulatory mechanisms. For some sites, it may be necessary for the Regional Board to use its regulatory authority to identify previous owners and operators, issue permits and orders, compel or initiate site cleanup, and conduct follow up monitoring (Steps G – J, unshaded area in Table 2). Possible next steps and priorities for known mine sites in the Bay Area are summarized in Table 3. Mine sites can be tentatively divided into four categories according to priority: low, medium, high, and highest priority. The priorities may change as new information is discovered.

2.3.1 Low priority sites

Sites are assigned a low priority if there are no obvious discharges, there is low connectivity to the Bay, and there is no immediate threat to fisheries resources in downstream reservoirs, embayments, or other sensitive habitat areas within the jurisdiction of the San Francisco Bay Regional Water Quality Control Board.

The Silverado Mine in Napa County was inspected in 1997. Moderately elevated mercury concentrations were found in soils and sediments (2-5 ppm), and the mercury concentrations in the lower mine drainage (1.5 µg/L) exceed the statewide numeric objective (0.050 µg/L) by a factor of 30. Mercury loads from this mine are discharged into St. Helena Creek, which flows into the Lake Berryessa Watershed in the Central Valley Region. While the Central Valley Regional Water Quality Control Board will need to consider impacts of this mine on the beneficial uses of St. Helena Creek and downstream waterbodies, this mine is assigned a low priority for the San Francisco Bay mercury TMDL because of its low connectivity to the Bay.

The Chilleno Valley mine site in Marin County was inspected in 1991 and determined to be adequately managed. There was no evidence of tailings or excessive erosion, and so the only action taken was to work cooperatively with the property owners and the local Resource Conservation District to assure long term stability with respect to erosion. Essentially all of the necessary boxes have been checked for this site. For the future, Chilleno Creek may be considered for inclusion as a watershed assessment site through monitoring conducted by Marin County Stormwater Pollution Prevention Program (STOPPP) to verify that no additional BMPs are needed to protect downstream water quality.

According to a 1997 survey, the Challenge Mine site in San Mateo County has no visible impacts to land or waters – in fact, the mine itself cannot be found. Sediments from a drainage adjacent to the mine area have 10 ppm mercury, which probably explains why

the water in that drainage exceeds the statewide numeric objective for mercury (0.050 µg/L) by a factor of 25 (1.2 µg/L). This area likely represents a common situation in coast range drainages, where cinnabar formations, both natural and disturbed, result in elevated mercury concentrations in soils and sediments. The most appropriate action for this location is to include the drainage (Arroyo Ojo De Agua Creek) in watershed assessments conducted by San Mateo County STOPPP in order to determine whether additional BMPs are necessary to protect downstream water quality. Because a children's play area is located in the vicinity, it may also be prudent to prepare a risk communication project, to help local users understand the difference between the risk of mercury exposure through the food chain vs. the relatively low risk posed by direct exposure to naturally occurring mineral formations.

The Silver Creek Mine in Santa Clara County is another area where there is no visual evidence of mine tailings or waste discharging to waters of the State, and low to moderate (2 ppm) concentrations of mercury in sediments near the mine area, according to a 1997 inspection. Silver Creek can be included in watershed assessments conducted by the Santa Clara County Urban Runoff Pollution Prevention Program (the SCVURPPP) to determine if BMPs are needed to protect downstream water quality.

In summary, for the low priority sites, the only actions likely to be necessary to fully implement the Basin Plan Mines Program are:

- 1) Identify property owners;
- 2) Communicate findings and recommendations to property owners, local RCD, and local stormwater management agency as appropriate;
- 3) Include the downstream drainage as part of a rotating watershed assessment within the next ten to twenty years.

2.3.2 Medium Priority Sites

Medium priority sites, like low priority sites, are those which have relatively low connectivity to the Bay, and lack visible evidence of mine waste discharging into state waters. Factors that elevate sites from low to medium include the presence of fishable reservoirs downstream that may be impacted by mercury, or lack of sufficient inspection and monitoring data to downgrade to a low priority site.

The Franciscan Mine and the Cycle Mine in Marin County are in the drainage basin of Soulajule Reservoir. Inspection of the Franciscan mine site in 1997 revealed no identifiable discharges to state waters. The Cycle mine site is presumed to be submerged by Soulajule Reservoir. Because Soulajule Reservoir is fished for crappie and large mouth bass, an assessment of mercury levels in fish and a study of local consumption patterns from this reservoir are the most appropriate actions. This should be coordinated through the Marin County Water District, which owns the reservoir.

The Hastings Mine in Solano County was inspected in 1997. Erosion from the mine area was characterized as minor. Similar to other smaller mine sites, sediments from the

drainage below the mine were found to have 10 ppm mercury, and spring water below the mine area was found to have 0.31 µg/L mercury, exceeding the statewide numeric objective for mercury by approximately six-fold. Drainage from the mine site flows into Lake Herman, which is listed as impaired due to mercury because of elevated mercury levels found in fish. Therefore, the most appropriate action is to work cooperatively with the City of Benecia, which owns Lake Herman, to conduct appropriate risk communication efforts, and to evaluate alternatives for managing the lake and its watershed which can help reduce mercury levels in fish. The current landowner of the Hastings mine site should be identified and contacted as well, and a follow-up visit should be conducted to determine whether additional BMPs are needed at this site.

The St. Johns Mine in Solano County produced considerable amounts of mercury – about 20,000 flasks. Although large hillside scarring and tailings piles greater than 10,000 cubic yards distinguish the site, a 1997 inspection reported that erosive discharges of mine tailings appear to be minimal. The drainage from the site flows through Rindler Creek into Chabot Lake, which is owned by the City of Vallejo. Chabot Lake is used for recreational fishing. Therefore, the most appropriate action is to assess mercury levels in fish from Chabot Lake, and coordinate risk assessment and communication with the City of Vallejo. Like Lake Herman, if mercury levels in fish from Chabot Lake are determined to be a problem, alternatives for managing the lake and its watershed should be developed. The property owner of the St. John's mine site should be identified and contacted, and the downstream drainage should be included in future watershed assessments conducted by the Vallejo Sanitation and Flood Control District to determine if additional BMPs at this site are needed.

The Corda Mine site in Marin County was inspected from an airplane reconnaissance in 1997, when a possible surface excavation was identified near the reported mine coordinates. Access to the site was impeded by private property restrictions, so an inspection on the ground has not been conducted. Therefore, the most appropriate next step is to identify and contact the property owner, conduct an inspection, and include the downstream drainage in watershed assessments conducted by Marin County STOPPP.

In summary, the following steps are likely necessary for most medium priority sites:

- 1) Identify property owners;
- 2) Communicate findings and recommendations to property owners, local RCD, and local stormwater management agency as appropriate;
- 3) Conduct targeted risk assessment and risk communication, in coordination with appropriate local agency;
- 4) Conduct targeted monitoring; and
- 5) Consider special studies to evaluate mercury cycling and bioaccumulation.

2.3.3 High Priority Sites

Mine sites are assigned a high priority because of documented discharges into waters of

the State, high connectivity to the Bay, or obvious threats to downstream habitat.

The Mount Diablo Mercury mine is located in Contra Costa County, in the Marsh Creek drainage. Although the mine and its drainage are located within the Central Valley Regional Water Quality Control Board's jurisdiction, it is included in this report because Marsh Creek discharges into the San Joaquin River just upstream of the jurisdictional boundary of the San Francisco Bay Region, and because the Contra Costa Countywide Clean Water Program is regulated by both the San Francisco Bay and Central Valley Regional Water Quality Control Boards.

The magnitude of mining waste, discharges into Marsh Creek, and impacts to sediments and biota have been well documented (Slotton et al., 1996). Concerns over mercury discharges from Marsh Creek have delayed implementation of planned wetland habitat restoration projects downstream at Big Break, on the San Joaquin River. An important next step is to coordinate with the Central Valley Regional Water Quality Control Board to determine when staff will be assigned to initiate actions necessary to eliminate the discharge of mercury pollution into waters of the State.

The La Joya Mine in Napa County was observed in 1997 to have steeply cut tailings in contact with surface water. Because of the high potential to discharge mining waste into State waters, and because of the relatively high connectivity to the Bay through the Napa River, this is considered to be a high priority site. The next steps are to identify and contact the current property owner, and coordinate with the Napa County RCD to develop and implement a Site Management Plan. Depending on the level of cooperation attained, regulatory action by the Regional Board may or may not be needed to initiate monitoring and remediation.

The Bella Oaks and Borges mine sites in Napa County were inspected in 1997. There was no visible evidence of potential discharge to state waters at either location. However, because of the high connectivity to the Bay, follow-up monitoring and loads assessment should be conducted to determine whether either site represents a significant controllable source of mercury to the Bay. The Borges Mine drains into American Canyon Creek, and so monitoring and loads assessment could be coordinated with the City of American Canyon STOPPP. The Bella Oaks mine is located on private property in unincorporated Napa County, so monitoring and loads assessment may need to be conducted as a special project of the CEP, a proposition 13 proposal, a 319-grant project, or through some other funding mechanism.

2.3.4 The Gambonini Mine

Considerable progress has been made at the Gambonini mine. Although this site does not discharge into San Francisco Bay, it is included in this report as an example of how high priority mine sites can be managed.

This site was assigned an extremely high priority because of its threat to downstream commercial and recreational fisheries. Because of the high priority and the inability of the

current landowner to pay for remediation, the Regional Board used funds from the State Cleanup and Abatement Account pursuant to section 13304(b) of the Porter-Cologne Water Quality Control Act. In contrast to the liabilities incurred by the State at Penn Mine and Leviathan Mine in the Central Valley, the San Francisco Bay Regional Water Quality Control Board was shielded from liability by allowing the U.S. Environmental Protection Agency to take the lead as an emergency response action.

The property owner has been contacted and was issued a cleanup and abatement order in 1993. Remediation was coordinated with the Marin County RCD. Loads were assessed through monitoring prior to remediation (Whyte and Kirchner, 2000). Waste piles have been stabilized and re-graded, and follow-up monitoring is being conducted to assess the post remediation load and determine the extent of downstream impacts to water quality. The total cost of the cleanup and monitoring to date has been approximately \$2,000,000.

2.3.5 The New Almaden Mining District

New Almaden and its associated mine sites present a unique case, because of the amounts of mercury produced, the size of the affected area, the complex ownership history, and the series of litigation, enforcement, monitoring, and remedial actions that have occurred and are ongoing.

Site History

New Almaden was at one time the largest producer of mercury in North America (Cargill et al., 1980), yielding over 35 million kilograms of mercury which was used first in gold mining and later in support of defense-related munitions production. It consists of several mercury mines, including New Almaden Mine, America Mine, Providencia Mine, Enriquita Mine, San Antonio Mine, San Mateo Mine, Senator Mine, and Guadalupe Mine. These mine sites are identified in Figure 4-5 and Table 4-16 of the Basin Plan. The discharge of mining waste from these areas has polluted Almaden Reservoir, Guadalupe Reservoir, and Calero Reservoir. Those reservoirs serve as water supply for groundwater recharge in the Santa Clara Basin. Numerous gulleys and small tributaries upstream of the reservoirs have been polluted. Downstream of the reservoirs, Arroyo Calero, Guadalupe Creek, and Alamitos Creek and the Guadalupe River have been polluted. The Guadalupe River conveys mercury-polluted sediments through Alviso Slough into lower South San Francisco Bay, which is part of the San Francisco Bay National Wildlife Refuge.

Mining in the area took place from 1845 until the most of the land was acquired by Santa Clara County in 1975, at which time all mining activity ceased. Persons or companies known to have mined mercury include:

Don Andreas Castellero	(deceased);
Alexander Forbes	(deceased);
George H. Sexton	(deceased);
Quicksilver Mining Company	(bankrupt);
New Almaden Inc.	(defunct);

New Idria Mining and Chemical Company (defunct); and
Cordero Mining (defunct).

In 1996, litigation over the issue of liability for the cleanup was settled, with financial responsibility divided between Santa Clara County, Myers Industries, Inc. (successor to New Idria Mining and Chemical Co.) and Newson, Inc. (successor to New Almaden, Inc.) (Rogers, 1996). It also is possible that a corporate successor to Cordero Mining exists, although if that information has been discovered it has not been published in a readily available document.

Current Status

Currently, lands and watercourses in and affected by inactive mercury mine sites of the New Almaden district are owned by:

County of Santa Clara	(public agency);
Mid-Penninsula Regional Open Space District	(public agency);
Guadalupe Rubbish Disposal Company Inc.	(private landowner); and
Santa Clara Valley Water District	(public agency);
City of San Jose	(public agency);
Private homeowners	(private landowners).

In 1987 the California Department of Toxic Substances Control (DTSC) ordered Santa Clara County to clean up areas within the County Park to protect human health from direct exposure to mercury. By 1998, remedial actions had been implemented in the park at Mine Hill, the Hacienda Furnace Yard, the Enriquita Mine Retort, the San Mateo Mine Retort, and the Senator Mine. The primary remedial actions undertaken were onsite containment via vegetated soil covers, substantial re-grading on mine hill, and a 1500 foot long rock and wire mesh barrier at the Hacienda Furnace Yard along the banks of Alamos Creek (California Department of Toxic Substances Control, 2002). The total cost of remedial actions completed through this process has been approximately \$4.2 million.

While DTSC has certified that threats to human health through direct contact have been mitigated, monitoring data suggests that additional work is needed to attain water quality standards. Fish collected from Almaden, Calero, and Guadalupe Reservoirs have mercury concentrations exceeding FDA action levels, prompting consumption advisories (Woodward Clyde Consultants, 1992). Stormwater monitoring data submitted by the County Parks indicates that the Basin Plan water quality objective for mercury (0.025 µg/L) is routinely exceeded during storm events. Mercury-polluted sediments have been distributed downstream, with concentrations increasing from 1 - 5 ppm at the base of the watershed to 10 – 50 ppm in the upper stream reaches. When these mercury-polluted sediments accumulate in sub-oxic areas (e.g., behind drop structures and diversion dams), methylmercury is formed at concentrations high enough to pose a substantial risk of bioaccumulation (Thomas et al., 2002).

There are at least seven programs or processes currently related to New Almaden, the Guadalupe River, and its tributaries and watersheds:

- 1) NPDES general industrial stormwater permits cover both the County Parks and the Guadalupe Landfill. These permits require basic stormwater monitoring.
- 2) The SCVWD is permitted to conduct operations and maintenance in streams and tributaries through a Waste Discharge Requirement (WDR).
- 3) There are three flood control projects planned or under way in the Guadalupe River, in its lower, middle, and upper reaches. These projects are subject to WDRs and water quality certifications ("401-certs"), and also require coordination with other resource agencies (e.g., California Department of Fish and Game, United States Fish and Wildlife Service) through the Guadalupe River Flood Control Collaborative.
- 4) The United States Fish and Wildlife Service is discussing the possibility of a Natural Resources Damage Assessment (NRDA) with potentially responsible parties. (Santa Clara Basin Watershed Management Initiative, 2001)
- 5) The Santa Clara Valley Pollution Prevention Program (SCVURPPP) conducts watershed assessment and monitoring through compliance with its NPDES permit regulating the discharge of urban stormwater, as well as through participation in the Clean Estuary Partnership.
- 6) The Clean Estuary Partnership has provided funds to initiate the first year of a multi-year loads assessment on the lower Guadalupe River (Mckee and Leatherbarrow, 2002).
- 7) The South Bay Watershed Management Initiative (SBWMI) has formed a TMDL workgroup for the Guadalupe River. Through that workgroup, a contractor has been selected and a scope of work developed to produce a TMDL for mercury in the Guadalupe River. That TMDL addresses both mercury impairment in the Guadalupe River watershed as well as the Guadalupe River as a source of mercury to Lower South Bay.

Next Steps to Consider in the Guadalupe River Watershed

The scope of the multi-year loads assessment initiated by the Clean Estuary Partnership overlaps with self-monitoring requirements of WDRs issued to the SCVWD for flood control projects. Therefore, negotiating a funding partnership with the SCVWD or the U.S. Army Corps of engineers to support subsequent monitoring years is a useful next step that Regional Board staff could undertake.

The monitoring requirements of the NPDES general stormwater permits covering the County Park and the Landfill may need to be reviewed and revised. The current approach in the general permit is to sample first flush. This approach may not be appropriate to mining-impacted watersheds, when erosive remobilization may take place after first-flush events. Monitoring should address mercury loads and mercury methylation processes: where are there controllable loads, how do loads respond to BMP implementation, where is mercury converted to methylmercury, and are there any management actions possible that minimize either the transport of mercury into methylating areas or that reduce net

methylation rates?

The framework for answering these questions is best established through development of the Guadalupe River mercury TMDL. During the Fall of 2003, a conceptual model and data collection plan will be prepared and reviewed by the South Bay WMI's Guadalupe River Mercury TMDL workgroup.

In summary, the most important next steps at high priority sites are:

- 1) Locate and contact property owners;
- 2) Conduct responsible party search;
- 3) Issue permits, waivers, or cleanup and abatement orders, as appropriate;
- 4) Identify funding sources (Prop-13, Prop-50, Prop-40, 319-H grants) that could help close funding gaps when responsible parties cannot be identified.
- 5) Coordinate with other State and Federal regulatory and resource agencies, including DTSC, USFWS, and USEPA. DTSC Coordination will be essential in any situations requiring movement of soils having mercury concentrations above hazardous waste guidelines.

3. Summary of Approaches to Managing Mining-Impacted Watersheds

Watersheds impacted by mining can be subdivided into three general areas: upstream, instream, and downstream. Each area requires a different management approach, and will involve different groups of stakeholders. The following discussion summarizes some general approaches to be considered in each area.

3.1 Upstream management

Upstream, at the actual mine site(s), the approach is to identify soils, sediments, and waste piles bearing high concentrations (> 10 ppm) of mercury. These should be stabilized to reduce and eliminate the discharge of mercury-polluted sediments into State Waters. Visual cues to identify the need for this kind of action includes piles of waste rock or soil at a high angle of repose or in contact with State waters. Monitoring data needed before and after remediation includes mercury concentrations in soils and sediments, as well as in-stream monitoring of mercury and suspended load during storm events. Examples of this kind of management approach can be found at the New Almaden and Gambonini mine sites.

Some inactive mines may also be discharging acid mine drainage into State waters. In this case, the appropriate management actions are to divert surface water away from mine openings to reduce the water supply into the mines, and to capture and treat any discharges fed by subterranean flow. Visual cues that acid mine drainage is a problem include severely discolored water and total devastation of aquatic life for miles downstream of the discharge. Monitoring data needed before and after remediation includes pH, suspended load, and metals. While there are not any known discharges of acid mine drainage from mercury mine sites in the Bay Area, the New Idria mercury mine site in San

Benito County is an excellent example of how simple visual observations combined with monitoring data can point out obvious ongoing threats to water quality (Ganguli et al., 2000; San Benito County, 2003).

Typically, the responsibility for implementing management actions on mine sites falls to the current landowner and / or any previous land owners or mine operators. Responsibility for monitoring can fall either to the landowner and other responsible parties, or it may be undertaken as part of a regionally coordinated effort through stormwater programs, flood control agencies, or other special districts.

3.2 In-stream management

In-stream management needs to consider two factors: mercury loads and mercury methylation. In watersheds where substantial amounts of mercury have already been transported downstream, the majority of the mercury load may come from stream bed and bank erosion. Severely downcut areas provide important visual cues. Other approaches to assess the role of in-stream remobilization include measuring mercury concentrations in sediments of stream beds and banks, modeling erosion and degradation processes, and combining in-stream continuous monitoring of flow and suspended load with discreet sampling to quantify total water column mercury. Load management actions are typically directed at reducing channel velocity by re-grading channel banks to allow overflow during peak flow periods. In-stream operations and maintenance and construction of new projects should include a soil management plan to minimize the downstream transport of mercury polluted sediments. The recent restoration project conducted at Guadalupe Creek (in the upper Guadalupe River Watershed) by the SCVWD is an example of this kind of in-stream management.

The Guadalupe Creek restoration also shows how projects can consider mercury methylation. Prior to implementing the restoration, the project area was monitored to determine where elevated concentrations of methylmercury existed. The most significant pre-project finding was that mercury methylation was associated with low oxygen conditions. Based on the assessment, the restoration project was deemed by the project proponents to be a net benefit, because by restoring cold water fisheries habitat, the project would minimize stagnant pools and other areas prone to low oxygen conditions (Tetra Tech, 2000).

Responsibility for in-stream management and monitoring typically falls to flood control districts, riparian landowners, and/or project proponents with mitigation requirements attached to stream impacts.

3.3 Downstream management

Downstream, management alternatives for receiving waters will vary greatly with the nature of the waterbody in question. There are at least three downstream management scenarios relevant to the Bay Area that can be considered:

- 1) Lakes and reservoirs;
- 2) Planned wetland projects; and
- 3) Depositional zones at the estuary interface.

3.3.1 Lakes and Reservoirs

Lakes and reservoirs downstream of mine sites tend to act as sediment traps, substantially reducing the mercury load from mine sites to the Bay. Therefore, the management focus for mining-impacted lakes and reservoirs shifts away from loads discharge to the Bay, and towards the beneficial uses of the lakes and reservoirs themselves. Initial monitoring and risk assessment should be directed at the following questions:

- 1) Who fishes the lake or reservoir?
- 2) What fish are being caught for food?
- 3) What is the concentration of mercury in those fish?
- 4) Are consumption advisories needed?
- 5) If risk assessment shows that concentrations of mercury in fish are too high, what management alternatives are available to reduce those concentrations?

After conducting the necessary risk assessment and communication, and controlling all controllable upland mercury sources, lakes and reservoirs that still have consumption advisories could be considered for pilot implementation projects to reduce mercury levels in fish through oxygenation (e.g., Abu-Saba et al., 2003) or manipulation of other water quality factors, such as nutrients or flow. Municipal governments and water suppliers who own fishable reservoirs could consider applying for funding from CALFED or other funding sources to implement such pilot projects.

In the Bay Area, some mining-impacted reservoirs that could be considered for pilot projects include:

Almaden Reservoir (Santa Clara Valley Water District);
Guadalupe Reservoir (Santa Clara Valley Water District);
Calero Reservoir (Santa Clara Valley Water District);
Lake Herman (City of Benecia);
Chabot Lake (City of Vallejo); and
Soulajule Reservoir (Marin County Water District).

3.3.2 Wetland restoration projects

Wetlands are the second type of downstream waterbody potentially affected by the discharge of mining waste. Wetlands can potentially be areas of enhanced methylation because of their microbial communities, and enhanced bioaccumulation because of their complex food webs. Adaptive management questions about mercury in wetlands are

discussed in a separate report, and so are only briefly summarized in this report with respect to inactive mine sites.

The central mercury questions about the best approach to designing, constructing, and managing Bay Area wetlands are:

- 1) What mercury concentrations in sediments produce substantial increases in the risk of mercury exposure to humans and wildlife if those sediments are used in wetland projects?
- 2) What are some wetland design features (e.g., channel depth and configuration, covering vegetation, flushing rates) that affect mercury methylation rates?

Some important areas to address these questions include:

- 1) The Montezuma project in the northern reach of the Bay, where dredged Bay sediments (with mercury concentrations predominantly around 0.4 ppm) are being used to restore a tidal wetland;
- 2) The planned Big Break wetland restoration in the northern reach, which is downstream of the Mount Diablo Mercury Mine; and
- 3) The planned restoration of Pond A4 in lower South Bay, where a need exists for substantial amounts of foundation sediment because the pond is so subsided. The nearest source of readily available sediment is the regular dredging of the lower Guadalupe River for maintenance of flood capacity. However, dredged sediments from the Guadalupe River can be expected to have elevated mercury concentrations, so it is important to determine whether the use of these sediments as foundation material increases the risks of methylmercury exposure in the restored wetland habitat.

3.3.3 Depositional zones

One of the complicating factors in evaluating watershed loads is quantifying the transfer of pollutants through depositional zones. Sediments tend to deposit at the estuary interface, where flow velocities slow down and transport shifts from fluvial to tidal mixing (McKee and Newland, 2002). In some cases, these depositional zones are managed by flood control agencies or other special districts. A notable example where the effect of management actions in the depositional zone on mercury loads needs to be evaluated is in lower South Bay. The depositional zone of the lower Guadalupe River is managed by the Santa Clara Valley Water District. Monitoring studies in the region should focus on how much mercury is entering the depositional zone from fluvial transport, how much is removed through maintenance dredging, and what is the resulting net transfer of mercury into lower South Bay.

4. Cost-Benefit Analysis

4.1 Framework for predicting implementation costs

The costs of implementing the Basin Plan Mines Program can be projected by considering what implementation would take in terms of Regional Board staff time, other public agency staff time, and contract dollars to conduct monitoring, risk assessment and communication, and remediation. While there is insufficient information at present to rigorously predict future levels of effort, a framework for predicting costs is presented in Table 4. The table divides implementation into two phases: Phase 1 consists of the inspections, outreach, and risk assessment needed for all sites. Phase 2 represents more focused remediation and management efforts at a more limited subset of mine sites. Based on the assumptions about number of sites, priority, and levels of effort needed presented in Table 4, Phase 1 implementation of the Basin Plan Mines program is expected to cost approximately \$1 million, whereas Phase 2 implementation would cost approximately \$10 million. If fully funded, Phase 1 implementation could reasonably be completed within five years, whereas Phase 2 implementation could take 10 – 20 years before all sites are considered complete.

These estimates do not include costs associated with the Guadalupe River, which is a unique case because of the magnitude of mercury mobilized from the New Almaden mines. The DTSC-ordered remediation at New Almaden cost approximately \$4.2 million. Development of a TMDL for the Guadalupe River to attain water quality standards is expected to cost between \$ 1 million - \$2 million. The implementation cost of that TMDL is unknown at present.

4.2 Funding mechanisms and public policy implications

There are four general revenue streams that could fund the mine site monitoring and remediation projects discussed in this report:

- 1) Federal funds. This includes programs such as the non-point source reduction program (US EPA's "319-h" grants that are administered by the SWRCB), and the U.S. Army Corps of Engineers Rehabilitation of Abandoned Mines (RAMS) program. Use of these funds spreads the costs of implementation among all U.S. taxpayers.
- 2) State Funds. This includes special voter-authorized bonds such as the Costa-Machado a Act (Proposition 13). Use of these programs spreads the cost of implementation among California taxpayers.
- 3) Local Government and Public Agency Funds. This includes property taxes, flood control fees, and sewerage rates. Although use of sewerage rates to remediate mine sites has been proposed as a "mass offset" in other contexts (Taylor, 1998; CVRWQCB, 2000), the legal basis for such an offset program is as yet unresolved. Use of local funds spreads the costs of implementation among local taxpayers and ratepayers.

- 4) Enforcement. In some instances (e.g., New Almaden, New Idria) the economic resources created from mercury exploration and production may be traceable to financially viable responsible parties. Enforcement assigns the cost of cleanup to the revenue stream derived from causing the pollution in the first place.

The particular approach used to fund remediation will vary by site. It is unlikely that any one of the above four revenue streams will take care of all mine sites in need of remediation. When determining who should pay for a project, the Regional Board can consider, among other factors:

- 1) Were the economic benefits of mining private, local, statewide, or national in scope? Mercury produced in California supported the Gold Rush, which underpinned the economic development of the State. Gold produced in California helped the Union win the Civil War. Mercury produced at New Idria helped fight World War I, World War II, the Korean War, and the Vietnam War, and thus was a benefit to the national defense. The profits from that mercury were used to build significant investment portfolios and sizable manufacturing corporations (see for example, report by San Benito County, 2003).
- 2) Will the economic and environmental benefits of remediation be local, statewide, or national? In some instances the main benefits of remediation will be localized to individual stream reaches or small lakes and reservoirs. In other instances, remediation has implications for reducing mercury loads to significant public resources, such as the San Francisco Bay National Wildlife Refuge (downstream of New Almaden), or the Mendota Wildlife Area (downstream of New Idria).
- 3) What funds are available? If Regional Boards are unable or unwilling to pursue enforcement against private responsible parties, costs to the public will increase. Absent enforceable programs, funding partnerships with Federal and State Programs can significantly reduce the fiscal burden on local governments. If the only revenue stream available is from local taxes and fees, the scope and priority of projects will be constrained by other local funding priorities, such as police, fire protection, infrastructure, and social services.

4.3 Benefits of implementation

When evaluating the benefits of implementation, both the benefits to the entire Bay (the TMDL basis) and benefits to the immediate watershed should be considered. Six of the mine sites listed in Table 3, (New Almaden, Mount Diablo, Borges, Bella Oaks, La Joya, and Corda) have relatively straightforward connections to the Bay. Without additional monitoring information, it is difficult to estimate the load reduction to the Bay that might be attained through remediation. Of the six, only the Guadalupe River, downstream of New Almaden has meaningful loads monitoring information.

Loads from the Guadalupe River into the depositional zone at the nexus to the Bay amount to approximately 100 kg/yr, with a likely range of 5-750 kg (Abu-Saba and Tang, 2000;

Clean Estuary Partnership, 2003). Additional questions that need to be answered to quantify the load reduction benefit possible from the Guadalupe River include:

- 1) What is the load removed from the depositional zone due to maintenance of flood control capacity?
- 2) How will the load into the depositional zone respond to upstream BMPs?

But with the available information, it is reasonable to estimate that the load reduction to the Bay that could possibly be attained through watershed management in the Guadalupe River will be smaller than 100 kg/yr. The other five Bay Area mercury mine sites, which were much smaller in production, can be expected to have proportionally smaller loads. Hence, it is unlikely that load reductions attained through mine site remediations will exceed 100 – 200 kg/yr Baywide.

Benefits to local watersheds are more readily identifiable. Stopping the discharge of mercury into potentially fishable lakes and reservoirs (e.g. Almaden Reservoir, Guadalupe Reservoir, Lake Hermann, Lake Chabot) can restore and protect local fisheries resources. Conducting necessary risk assessment and communication targeting such lakes has the immediate benefit of protecting public health and raising public awareness about the problems of and possible solutions to much mercury bioaccumulation in fish. Stream restoration projects (e.g., Guadalupe Creek) that have direct stream habitat benefits also reduce mercury loads, and maintain or decrease mercury methylation rates.

Thus, while the nexus remains uncertain between the Basin Plan Mines Program and the Bay Mercury TMDL targets, there are very likely benefits possible to mining-impacted watersheds themselves. When setting priorities and determining next steps, factors to be considered should include not only “is a proposed project good for the Bay,” but also “will a proposed project improve the immediate watershed.” Such an approach can enhance local support and speed up implementation of remediation projects.

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		Location information		Site History		
Mine	Basin Plan Map Key	Coordinates	Location	Type	Operation dates	Production
Silverado	3	38 deg. 39.13' N; 122 deg. 36.23' W	Napa County. Access is off highway 29 neat Mt. Saint Helena	Underground and open cuts	1872 - 1948	2000 flasks
Chileno Valley	11	37 deg. 10.77' N; 122 deg. 46.94' W	Northwest Marin County, east of Tomales Bay, 50 miles north of San Francisco (near Gambonini Mine)	Underground	1955-1970	Unknown
Challenge	29	37 deg. 27.23' N; 122 deg. 15.02' W	San Mateo County. Access is off Farm Hill Rd.	Surface and Underground	1955-1958	Unknown
Silver Creek	31	37 deg. 16.03' N; 121deg. 44.9' W	San Jose, off silver Creek Rd. Main mine located upstream from Silver Creek rd. about 1/2 mile. Santa Clara County.	Surface and Underground	Inactive 1940's	Unknown
Cycle	9	38 deg. 8.80' N; 122 deg. 45.02' W	Marin County. Access through N. entrance to SoulaJule Reservoir	Underground	1970-1971	Unknown
Franciscan	10	38 deg. 8.94' N; 122 deg. 45.20' W	Marin County. Access through N. entrance to SoulaJule Reservoir	Underground	1970-1971	Unknown
Hastings	5	37 deg. 27.23' N; 122 deg. 15.02' W	Solano County. Access is off west side of Sky Valley Rd.	Underground	1870's, intermittantly until 1930	Unknown
St. Johns	6	38 deg. 9.11' N; 122 deg. 11.37' W	Solano County. Mine is visible near eastern ridgeline at highway 80 and American Canyon Rd.	Extensive Underground	1870's, intermittantly until 1909	20,000 flasks
Corda	8	38 deg. 09.57' N; 122 deg. 37.74' W	Marin County. Located off of San Antonio Rd. on Corda Ranch	Surface	1968 - 1971	Unknown
La Joya	4	38 deg. 26.36' N; 122 deg. 28.26' W	Napa County. Access is off Wall Rd.	Underground	1865-1939	2000 flasks
Bella Oaks	NA		Napa County. Access is off Bella Oaks Rd about one mile south of Rutherford	Underground	1872-1910	1800 flasks
Borges	7	38 deg. 9.37' N; 122 deg. 12.98' W	Napa County. Access is off American Canyon Rd.	Underground / Minor Surface	Active August 1969	Unknown
Gambonini	12	38 deg 10.26' N; 122 deg. 46.70 ' W	Northwest Marin County, east of Tomales Bay, 50 miles north of San Francisco.	Surface and Underground	Intermittently 1945 - 1971	
New Almaden District	44-31	37 deg. 13' N ; 121 deg 50' W	Santa Clara County; Almaden Quicksilver County Park and surrounding lands	Surface and Underground	Intermittently 1854 - 1976	1,000,000 flasks

Table 1: Locations and site histories for inoperative mercury mines in the San Francisco Bay Region

	Site Condition					Site Management Tracking										
						(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	
							Site inspected from the ground?	Property owner identified?	Property owner contacted?	Other local agencies notified?	Site Management Plan Implemented?	Loads / risk assessment conducted?	Previous PRPs identified?	Permits and orders issued?	Remediation initiated?	Follow-up monitoring initiated?
Mine	Calcines, Tailings, and Waste Rock	Seds (ppm)	Water (ppb)	Drainage	Nexus to Bay	Date last inspected										
Silverado	<1000 cy	3	1.5	St. Helena Creek	Region 5	9/19/97	X									
Chileno Valley	None visible	NA	NA	Chileno Creek	No	6/15/91	X	X	X	X	X					
Challenge	None visible	10	1.2	Arroyo Ojo De Agua and Tributaries	Redwood Creek	4/28/97	X	X								
Silver Creek	None visible	2.1	0.14	Silver Creek	Coyote Creek	1/23/97	X									
Cycle	None visible	NA	NA	Soulajule Reservoir	No	10/16/97	X	X								
Franciscan	Small	NA	NA	Soulajule Reservoir	No	10/16/97	X	X								
Hastings	Yes	10	0.31	Sulphur Springs Creek	Lake Herman	9/4/97	X									
St. Johns	>10,000 cy	NA	NA	Rindler Creek	Lake Chabot	9/4/97	X									
Corda	Unknown	NA	NA	San Antonio Creek	Petaluma R.	(by air) 12/11/97										
La Joya	Contact w/ water	NA	0.25	Dry Creek / Napa R.	Napa R.	9/12/97	X									
Bella Oaks	Visible	NA	NA	Seasonal trib to Napa R.	Napa R.	9/12/97	X									
Borges	None visible	2.7		American Canyon Creek	Napa R.	9/4/97	X									
Gambonini	Massives				No	Ongoing	X	X	X	X	X	X	X	X	x	X
New Almaden	Massive	10 - 100		Guadalupe River	Alviso Slough	Ongoing	X	X	X	X	In Part	X	X	In part	In part	

Table 2: Current condition and site management of inoperative mercury mines in the San Francisco Bay region.

Mine	Possible Next Steps	Priority Basis for Priority
Silverado	Locate property owner; monitor / assess risk through BASMAA, CEP, or Central Valley RWQCB; coordinate SMP implementation with Napa County RCD, CVRWQCB	Low Outside SFRWQCB jurisdiction; low connectivity to Bay
Chileno Valley	Follow up with owner, Marin County RCD, to verify SMP implementation; monitor / assess risk through Marin County STOPPP, BASMAA, or CEP.	Low Basin Plan mines program implemented
Challenge	Monitor / assess risk through San Mateo County STOPPP, BASMAA, or CEP; coordinate SMP implementation and risk communication with San Mateo County Parks.	Low No visible waste, moderate concentrations of mercury in sediments
Silver Creek	Locate property owner; monitor / assess risk through SCVURPPP, BASMAA, or CEP; coordinate SMP implementation with SBWMI, Guadalupe-Coyote RCD.	Low No visible waste, relatively low concentrations of mercury in sediments
Cycle	Coordinate with Marin County Water District to determine if risk assessment / communication needed for fisheries resources in Soulajule Reservoir	Medium Does not discharge Bayside; mine site likely submerged by reservoir, recreational fishing use.
Franciscan	Coordinate with Marin County Water District to determine if risk assessment / communication needed for fisheries resources in Soulajule Reservoir	Medium Does not discharge Bayside; no visible waste, low-moderate mercury concentrations in soils; recreational fishing use.
Hastings	Locate property owner; monitor / assess risk through BASMAA or CEP; evaluate mercury cycling in Lake Herman through CALFED or CEP; coordinate risk assessment / communication with city of Benecia; coordinate SMP implementation with Suisun RCD	Medium Impacts municipal lake used for recreational fishing; low connectivity to Bay
St. Johns	Locate property owner; monitor / assess risk through Vallejo SFCD, BASMAA, or CEP; evaluate mercury cycling in Lake Chabot through CALFED or CEP, coordinate risk communication with City of Vallejo; coordinate SMP implementation with Suisun RCD.	Medium Impacts municipal lake used for recreational fishing; low connectivity to Bay
Corda	Locate and contact property owner; conduct on the ground inspection; monitor / assess risk through Marin County STOPPP, BASMAA, or CEP; coordinate SMP implementation with Marin County RCD, Marin County STOPPP	Medium No onsite inspection or monitoring information available, but no visible waste observed from air
Mt. Diablo	Coordinate with CVRWQCB, Contra Costa Countywide CWP, Contra Costa RCD; Locate and Contact property owner; seek funding to complete remediation and restoration.	High Well-documented unabated discharges that threaten downstream habitat restoration projects planned at Big Break and Marsh Creek
La Joya	Locate property owner; issue permits or waivers as needed to produce site management plan for mine tailings; monitor / assess risk through BASMAA or CEP; coordinate SMP implementation with Napa County RCD.	High Observation of "steep cut tailings... tailings in contact with surface waters..." and recommendation in Mines report
Bella Oaks	Locate property owner; monitor / assess risk through BASMAA or CEP; coordinate SMP implementation with Napa County RCD	High Connectivity to Bay
Borges	Locate property owner, monitor / assess risk through American Canyon STOPPP, BASMAA, or CEP; coordinate SMP implementation with Napa County RCD, American Canyon WTP, American Canyon STOPPP	High Connectivity to Bay
Gambonini	Remediation initiated, monitoring and watershed assessment under way	Highest Downstream commercial and recreational fisheries in Tomales Bay
New Almaden District	See Text	Highest Size of source, presence of unmanaged waste piles discharging into waters of the State

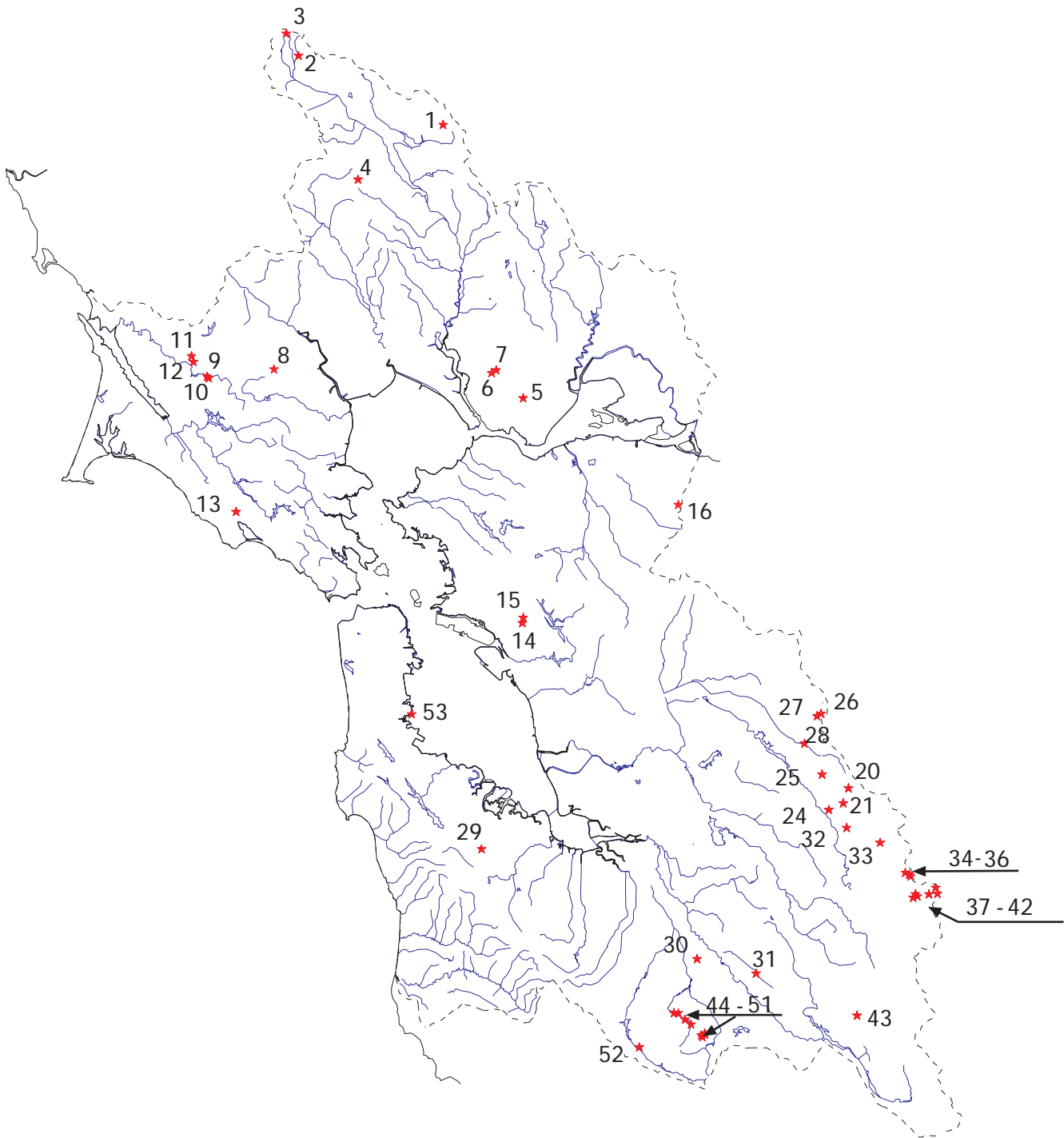
Table 3: Next steps and priorities for implementing the San Francisco Bay Basin Plan Mines Program

Phase 1 Cost / Site				
Site Priority	Number of Phase-1 Sites	Regional Board Staff Time (FTEs)	Other Agency Staff Time (FTEs)	Contracts (\$)
Low	4	0.1	0.1	5,000
Medium	5	0.2	0.2	10,000
High	6	0.2	0.2	50,000
Total	15	2.6	2.6	370,000
Total Cost				890,000

Phase 2 Cost / Site				
Site Priority	Number of Phase-2 Sites	Regional Board Staff Time (FTEs)	Other Agency Staff Time (FTEs)	Contracts (\$)
Low	0			
Medium	2	0.2	0.2	1,000,000
High	4	0.5	0.5	2,000,000
Total	6	2.4	2.4	10,000,000
Total Cost				10,480,000

Table 4: Framework for projecting costs of implementing the Basin Plan Mines Program. Phase 1 refers to completing steps A-F of Table 2 for all mine sites, Phase 2 refers to completing steps G-J of a more limited subset of mine sites.

***Appendix A: Excerpts from San Francisco Bay Basin Plan, Chapter 4
(Implementation Plan), describing the Mines Program***



★ MINES

Figure 4-5
Inactive Mine Sites

SCALE 1:960,000

8. IMPACTS AT DREDGE SITE

The Regional Board may require additional documentation and inspections during dredging activities in order to ensure that dredgers minimize impacts at the dredging location. Water quality certifications or waste discharge requirements may contain additional conditions to address barge overflow and other impacts at the dredging site. Permit conditions may include:

- Special reporting procedures for the hydraulic pumping of dredged material into transport scows prior to disposal (marina slip applications);
- Time limit on the overflow from hopper-type hydraulic dredges in order to obtain an economical load; or
- Precautions to minimize overflow and spillage from the dredging vessel when enroute to the authorized disposal site. (Appreciable loss during transit shall be considered unauthorized disposal, or "short dumping," and such occurrences are subject to enforcement by the Regional Board or other applicable state or federal agencies.)

9. POLICY ON LAND AND OCEAN DISPOSAL

The Regional Board shall continue to encourage land and ocean disposal alternatives whenever practical. Regional Board staff have determined that there should be a high priority placed on disposing of dredged sandy material upland. At a minimum, incentives should be developed to limit disposal of any such material with a market value to upland uses. Staff may condition certifications so as to encourage upland reuse of high value sediments.

10. POLICY ON DREDGED MATERIAL DISPOSAL PERMIT COORDINATION

The Regional Board will implement these measures through its issuance of waste discharge requirements, water quality certification under Section 401 of the Clean Water Act, or other orders. In addition, the Regional Board may require pre- and post-dredge surveys to determine disposal volumes and compliance with permit conditions. In order to better manage data and reduce paper files, Regional Board staff may request, but not require, that applicants submit testing and other project data in a specific electronic format. The Regional Board has been an active participant in efforts to improve the overall dredging permit process and procedures. The

goal of this effort is to provide the public with uniform testing and disposal guidelines, joint permit actions, a streamlined permit application process, and more uniform permit enforcement. Staff are working with other state and federal agencies to implement a combined state-federal dredging permit process. The process is generally based on the Washington State "Dredged Material Management Office," a part of the Puget Sound Dredged Disposal Analysis program (PSDDA), which regulates dredging and disposal in the Seattle and Tacoma regions.

MINES AND MINERAL PRODUCERS

INACTIVE SITES

Over 50 abandoned or inactive mines have been identified within the San Francisco Bay region (Table 4-16 and Figure 4-5). The mineral resources extracted include mercury, magnesite, manganese, coal, copper, silver, and gold. A large percentage of the mining activities took place from 1890-1930, although some areas were mined as recently as 1971. The sizes of these mines vary from relatively small surface mines of less than half an acre to the world's second largest mercury mine, the New Almaden District, located in southern Santa Clara County.

Water quality problems associated with mining activities can be divided into two categories:

- Erosion and sediment discharge from surface mines and ore tailings piles; and
- Acid or otherwise toxic aqueous discharge from underground mines, ore tailings, or other mining processes.

Problems of erosion and sediment discharged from mined areas may be intensified due to the fact that sediment from ore-rich areas typically contains high concentrations of metals. Biological processes that take place in lake and stream-bottom sediments may allow these pollutants to be released in a form that more readily bioaccumulates in the food chain.

Recent water quality and aquatic toxicity monitoring data suggest that the beneficial uses of a number of water supply reservoirs, creeks, and streams in the region have been impacted as a result of past mining activities. Threatened beneficial uses of lakes, streams, bays, and marshes due to mining activities so

far identified in the region include fish migration, fish spawning, shellfish harvesting, wildlife habitat, preservation of rare and endangered species, freshwater fisheries habitat, and water contact recreation. In response to these findings, surveys were conducted by Regional Board staff in order to locate all abandoned and operating mines in the region.

In many cases, the adverse results of previous surface mining activities can be reduced, and in some cases eliminated, through appropriate erosion and sediment control practices. The U.S. Natural Resource Conservation Service (NRCS, formerly Soil Conservation Service) has developed a Resource Management System for Surface Mined Areas. This management system references practices and treatment alternatives needed in order to address the following:

- Erosion control practices that will dispose of surface water runoff at non-erosive velocities and reduce soil movement by wind or water to within acceptable limits;
- Maintenance of adequate water quality and quantity for planned uses and to meet federal, state, and local requirements;
- Pollution control to meet federal, state, and local regulations; and
- A system of planned access and/or conveyance that is within local regulations and meets the needs for the intended use.

In 1980, a memorandum of understanding was negotiated with the Council of Bay Area Resource Conservation Districts in order to provide for assessment and monitoring of potential and existing soil erosion-related water quality problems and identification of control measures. It was agreed that local units of government should have the lead role in controlling land-use activities that cause erosion. Control measures include the implementation of best management practices (BMPs). The Resource Management System for Surface Mined Areas developed by NRCS specifically references BMPs determined to be the most effective and practicable means of preventing or reducing erosion- and sediment-related water quality degradation resulting from surface mining activities.

ACTIVE SITES

There are approximately 100 active mines and mineral producers within the San Francisco Bay region. The primary mineral commodities produced include clay, salt, sand and gravel, shale, and crushed stone. Water quality problems associated with mineral pro-

duction activities generally consist of erosion and sediment discharge into nearby surface water bodies and wildlife habitat destruction.

Active mining and mineral production activities are in part regulated under the Surface Mining and Reclamation Act of 1975. This act requires all mine operators to submit a reclamation plan to the California Department of Conservation, Division of Mines and Geology, and the recognized lead local agency for the area in which the mining is taking place. Recognized lead local agencies for the San Francisco Bay region include county planning and public works departments. Additionally, some local planning departments regulate mining activities through the issuance of conditional land-use permits. The goal of each reclamation plan is to assure that mined lands are reclaimed to a usable condition that is readily adaptable for alternate land uses and creates no danger to public health and safety. To date, very little emphasis has been placed on the need to protect beneficial uses of surface and groundwaters in the established permitting process.

Under the California Code of Regulations, Title 23, Chapter 15, Article 7, the Regional Board has the authority to regulate mining activities that result in a waste discharge to land through the use of waste discharge requirements. Additionally, the federal NPDES stormwater regulations (40CFR Parts 122, 123, and 124) require active and inactive mining operations to obtain NPDES permit coverage for the discharge of stormwater contaminated by contact with any overburden, raw material, intermediate products, finished products, byproducts, or waste products.

GOAL

The Regional Board's goal is to restore and protect beneficial uses of receiving waters now impaired or threatened with impairment resulting from past or present mining activities.

This goal will be attained by the coordinated effort of the Regional Board, NRCS, the Council of Bay Area Resource Conservation Districts, the California Division of Mines and Geology, and lead local government agencies through the implementation of a mineral production and mining management program.

PROGRAM

1. The Regional Board intends to continue to work closely with Resource Conservation Districts and NRCS to identify all existing and abandoned mines and mineral production sites in the region. Responsible

parties will be identified, as well as potential funding alternatives for clean-up activities, if needed. Sites will be prioritized based on existing and potential impacts to water quality and size.

2. The Regional Board will require an NPDES permit for the discharge of contaminated stormwater from active and inactive mining operations, as defined in the NPDES stormwater regulations. The Regional Board will consider issuing individual permits or a general permit for such discharges, or will otherwise allow coverage under the State Board general permit for stormwater discharges associated with industrial activity as described in the "Urban Runoff Management, Industrial Activity Control Program" section. Requirements of the notice of intent to be covered under the general permit(s) and the schedule for submittal will be established in the permit(s).
3. The responsible party or operator of each site discharging or potentially discharging waste to land shall be required to submit a Report of Waste Discharge to the Regional Board, pursuant to the California Water Code Section 13267. Requests will be made on a site-by-site basis and based on priority. A Report of Waste Discharge shall consist of a "Site Closure Plan" and an "Operation and Management Plan" for active sites.
 - Each plan shall be designed to ensure short- and long-term protection of beneficial uses of receiving waters.
 - The "Closure Plan" shall address site restoration and long-term maintenance and monitoring.
 - The "Management Plan" shall address stormwater runoff and erosion control measures and practices.
 - Each plan will be evaluated in regard to potential impacts to beneficial uses of receiving waters. Waste Discharge Requirements will be issued or waived at the discretion of the Regional Board based on the threat to water quality and the effectiveness of identified and implemented control measures and the effectiveness of local agency oversight.

VESSEL WASTES

The discharge of wastes from pleasure, commercial, and military vessels has been a

water quality concern of the Regional Board since 1968 when Resolution No. 665 was adopted, which suggested that the federal government regulate waste discharges from vessels. In 1970, the Regional Board adopted Resolutions 70-1 and 70-65 on vessel wastes. The first urged BCDC to condition marina permits for new or expanded marinas to include pumpout facilities, dockside sewers, and restroom facilities. Resolution 70-65 recommended that vessel wastes be controlled in such a manner through legislative action.

In 1982, the Regional Board conducted a study that found high levels of coliform in the vicinity of several marinas in Marin County's Richardson Bay. Subsequently, the Regional Board adopted a prohibition against discharge of any kind into Richardson Bay. A regional agency was formed to implement and enforce this prohibition.

There is an ongoing effort to construct, renovate, and improve pumpout facilities at marinas and ports around the region. The goal of these efforts is to increase the accessibility of these facilities to boaters and reduce pollution from vessel wastes.

WETLANDS PROTECTION AND MANAGEMENT

Wetlands and related habitats comprise some of the San Francisco Bay region's most valuable natural resources. Wetlands provide critical habitats for hundreds of species of fish, birds, and other wildlife; offer open space; and provide many recreational opportunities. Wetlands also enhance water quality through such natural functions as flood and erosion control, stream bank stabilization, and filtration and purification of naturally occurring contaminants.

The Regional Board will refer to the following for guidance when permitting or otherwise acting on wetlands issues:

- Governor's Executive Order W-59-93 (signed August 23, 1993; also known as the California Wetlands Conservation Policy);
- Senate Concurrent Resolution No. 28; and
- California Water Code Section 13142.5 (applies to coastal marine wetlands).

The goals of the California Wetlands Conservation Policy include ensuring "no overall net loss," achieving a "long-term net gain in the quantity, quality, and permanence of wetlands acreage and values ...", and reducing "procedural complexity in the administra-

Mercury Source Assessment for San Francisco Bay

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1. Executive Summary

Mercury loads to San Francisco Bay are estimated and incorporated in a mass balance to identify remaining uncertainties. The facts that mercury concentrations in sediments have not changed substantially over the past decade and that sediment outputs from the Bay roughly balance sediment inputs help constrain the mass balance, although the resulting range is relatively large. The best direct estimates of mercury loads to the Bay, including wastewater, stormwater, airborne deposition, and Central Valley runoff, total 640 kg/yr, with a likely range of 430-1350 kg/yr. The major portion of this total comes from Central Valley runoff and local stormwater sources. Mass balance considerations suggest that additional loads of 300 kg/yr enter the Bay, but the range on the additional load is between -2600 kg/yr and 3000 kg/yr. Steps to reduce this uncertainty and the expected outcomes are discussed.

2. Background

A mass balance model for mercury loads to San Francisco Bay is an important component of a mass-based watershed management strategy. This paper summarizes existing knowledge of mercury mass loadings to the Bay in a simple mass balance model that identifies remaining uncertainties and key steps to reducing those uncertainties.

3. Approach

The approach is to initially treat the Bay as the simple, one-box model depicted in Figure 1, and write down what is known about each of the first five terms: the Central Valley load, Bay Area urban stormwater, Bay Area non-urban stormwater, Bay Area wastewater, and direct air deposition onto the Bay. Then the mass balance is evaluated, to put an upper limit on the “additional loads.” This is a first order estimate which, in the absence of any other information, would be a reasonable basis for establishing a total maximum daily load for a particle-associated pollutant based on a target concentration in sediment.

Watershed loads (i.e., stormwater runoff from urban areas, non-urban areas, and the entire Central Valley) are estimated as the product of the average mercury concentration in watershed sediments times the average sediment load:

Equation 1

$$\text{Hg Load} = [\text{Hg}]_{\text{sed}} \times \text{Sediment Load}$$

Where (for each source category):

Hg Load = total mercury load (kilograms per year, kg/yr)

$[Hg]_{sed}$ = concentration of mercury in sediment (parts per million, mg/kg)

Sediment Load = sediment entering the bay (millions of kilograms per year, M kg/yr).

Local air deposition and wastewater loads are estimated from direct measurements (i.e., atmospheric deposition rates and mercury concentrations in wastewater).

“Additional loads” includes identified and unidentified mine sites, remobilization of polluted sediments from deeper layers of the bay floor, existing and potential hot spots along the Bay margins, and natural variations of local mineralogy. “Additional loads” also incorporates any missing loss terms, such as burial, offgassing, or biological uptake and removal.

Simplifying assumptions and resultant uncertainties in the overall approach

Two fundamental assumptions in developing a mass balance model for mercury in the Bay and its watersheds are that:

- 1) Watershed mercury loads can be estimated as the product of mercury concentrations in watershed sediments and the amount of sediment discharged from a watershed; and
- 2) The Bay can be modeled as a simple, single box of sediment, with all inputs and outputs treated as advective processes.

The first assumption is reasonable, although the methods used to select representative values for mercury concentrations in sediments and mass of sediment discharge can introduce considerable uncertainty. Also, rather than a simple product, a better approach is to model sediment loads and mercury concentrations dynamically, where the data are sufficient to do so. Dynamic modeling means using the relationships between flow, suspended sediments, and mercury concentrations in sediments to estimate loads. This approach has been implemented to estimate the Central Valley watershed load, and recommended for estimation of Bay Area stormwater loads.

The second assumption fails when attempting to describe dredging, tidal outputs, and exposure of old sediments, which are all mixing, rather than advective processes. However, as subsequent sections reveal, this simplified approach is sufficient to describe the overall picture of mercury loads to the Bay, and suggests next steps necessary to reduce uncertainties (i.e., develop a model that accounts for mixing between different segments of the Bay).

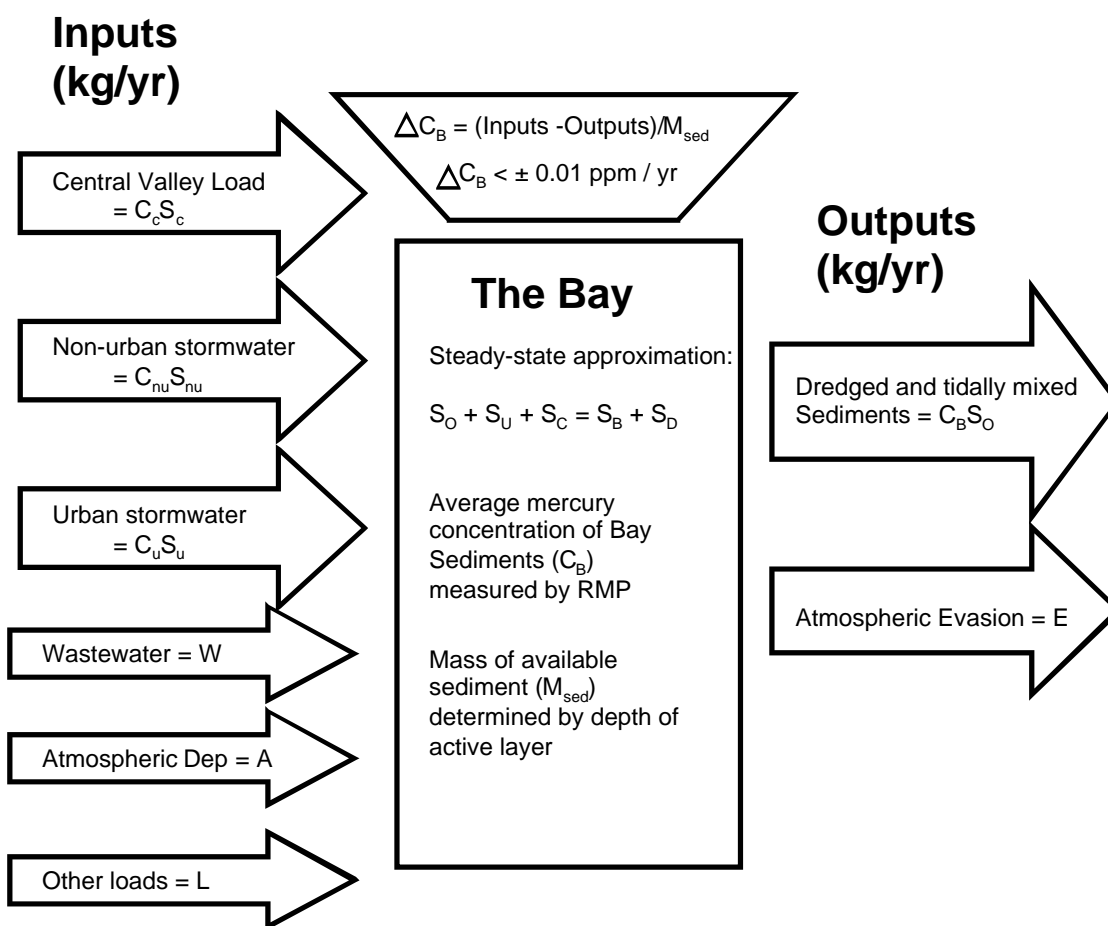


Figure 1: Conceptual illustration of the mercury mass balance for San Francisco Bay. C_x = mercury concentration in sediments (mg/kg), S_x = Sediment loading (M kg/yr), M_{sed} = mass of sediments available for resuspension (M kg), ΔC_B = rate of change in the average concentration of mercury in San Francisco Bay sediments.

4. Initial loads summary

4.1 The Central Valley Load

Hg Loads from the Central Valley = 435 kg/yr (range 240 – 630 kg/yr)

The best estimate for the average mercury concentration in sediments exported from the Central Valley range is 0.3 ppm, based on measurements at the Sacramento River mouth between March 2000 and October 2001 (McKee and Foe, 2002). Measurements by the RMP confirm that a likely range for this value is 0.2 ppm – 0.4 ppm (Appendix-1). Sediment loads from the Central Valley between 1995 and 2001 ranged from 300 to 2600 M kg/yr, based on continuous monitoring of suspended solids concentration (SSC) and flow (Buchanan and Ganju, 2002; Buchanan and Ruhl, 2000; Buchanan and Ruhl, 2001; Buchanan and Schoellhamer, 1996;

Buchanan and Schoellhamer, 1998; Buchanan and Schoellhamer, 1999). The six-year average discharge of sediments from that study was 1600 ± 300 M kg/yr. Dynamic modeling of sediment discharges and mercury concentrations result in an estimate of 435 ± 96 kg/yr for the mercury load discharged into San Francisco Bay from the Central Valley. These estimates represents six-year means; the uncertainty represents one standard error about the six-year means. The total range on the Hg load estimate (240 – 630) kg/yr represents \pm two standard errors around the mean.

**Simplifying assumptions and resultant uncertainties
in the Central Valley loads**

The dynamic modeling approach employed by McKee et al. makes the following assumptions:

- 1) The relationship between TSS and particulate mercury concentrations ([Hg]_p) measured in 2000 – 2001 represents the typical average mercury concentration in suspended particulate matter exported from the Central Valley.
- 2) Total Suspended Solids (TSS) and Suspended Solids Concentrations (SSC) are equivalent.
- 3) The six-year averaging period represents long-term trends.

The first assumption introduces uncertainty because the [Hg]_p / TSS ratio may, in fact, vary systematically with flow. This has been observed in other, smaller, mining impacted watersheds. The 2000 – 2001 sampling period represented relatively low-flow conditions. The uncertainty introduced by this assumption can be reduced using long-term monitoring data.

The second assumption introduces uncertainty because the two different analytical methods, TSS and SSC, don't always produce comparable values[Gray, 2000 #61]. The difference between the two methods comes down to subsampling. If a bottle of water is collected and its entire contents filtered to determine the dry mass of particles, the resulting measurement is the SSC. If a subsample of the bottle is filtered, then the measurement is the TSS. Subsampling can lose coarse sediments that settle between agitation and pouring the subsample, so TSS can be systematically lower than SSC, especially in waterbodies transporting large amounts of coarse sands ($> 63 \mu\text{m}$). The data used by [McKee, 2002 #31] to determine mercury concentrations in particles rely upon TSS measurements, whereas the data used to determine particle loads rely upon SSC measurements. In this case, the TSS and SSC measurements are thought to be comparable, because the sediments transported by the Sacramento River have been found to be predominantly fine materials ($< 12 \mu\text{m}$). The uncertainty of this assumption can be reduced in the future by either requiring SSC measurements from monitoring studies (i.e., no subsampling), and / or ultra-clean filtration to directly extract and analyze concentrations of mercury on filtered particles.

The third assumption can be re-evaluated as more sampling years are added. Preliminary results from the 2001 – 2002 water year suggest that the seven-year average mercury load is 383 ± 84 kg / yr. Evaluation of the true, long-term average requires enough monitoring to reproducibly capture the full range of flow conditions, and then application of the observed relationship between flow and loads to the long-term flow history of the Bay.

4.2 Stormwater loads

Hg loads from urban stormwater: = 180 kg/yr (range 60-300 kg/yr)

Hg loads from non-urban stormwater = 80 kg/yr (range 20 – 100 kg/yr)

Stormwater loads are divided into urban and non-urban components. These loads are assessed using the best estimate for sediment loads discharged from urban and non-urban watershed, and the best estimate for the concentration of mercury sediments discharged from urban and non-urban watersheds. Since rigorous assessments of discharged sediments are not available, assessments of bedded sediments in storm drain conveyances are used to make inferences about discharged sediments.

The best estimates for mercury concentrations in bedded sediments from storm drains from urban and non-urban catchments come from (Kinnetic Laboratories Inc., 2001).

Land Use	Average Total mercury (ppm)	Average Percent Fines (%)	Fines-normalized average mercury (ppm)
Urban	0.29	30	1.0
Non-Urban	0.06	30	0.2

Table 1: Summary of mercury and percent fines data for urban and non-urban land-use types. Data in first two-columns from page 39 of (Kinnetic Laboratories Inc., 2001). Fines-normalized concentrations in third column calculated by dividing the first column by the second column.

To relate bedded sediments to discharged sediments, this approach assumes that the average concentration of mercury in 100% fine, bedded sediments sets the maximum mercury concentration for mercury in discharged sediments. In other words, the working assumption is that bedded sediments are good predictors of discharged sediments, and the only uncertainty is that we don't know the particle size distribution of discharged sediments. From this, the maximum mercury concentrations in sediments discharged from open spaces is inferred from Table 1 to be 0.2 ppm, and the maximum for urban areas is inferred to be 1.0 ppm.

Following that logic, this approach assumes that the average concentration of mercury in bulk, bedded sediments (i.e., un-normalized concentrations) sets the minimum mercury concentration in discharged sediments. In other words, an additional working assumption is that discharged sediments are at least 30% fine, which is supported by the literature review of [McKee, 2002 #49]. Based on this assumption, the minimum mercury concentration in sediments discharged from open spaces is inferred from Table 1 to be 0.06 ppm, and the minimum for urban areas is inferred to be 0.3 ppm.

The mass of sediments discharged from urban and non-urban watersheds is estimated based on the total amount of sediment produced by local watersheds and estimates of the relative

contributions made each type of land use. Using mass-balance calculations, the total local tributary load of sediments is estimated at 440-970 M kg/yr (Krone, 1979). A more recent literature review places the range at 600 – 1000 M kg/ yr (McKee et al., 2002b), which is the range that will be used in this calculation.

A recent assessment of stormwater sediment loads using the “rational method” suggests that 70% of sediments are discharged from non-urban areas, and 30% from urban areas (Davis et al., 2000). The overall tributary sediment loads from (Davis et al., 2000) are 2-3 times lower than those of (McKee et al., 2002b), because of the data and assumptions used. The “rational” method accounts for the different sediment production rates per unit area for different land uses and topographies, so the assessment by (Davis et al., 2000) provides the best estimate for the fractional contribution from urban and non-urban areas. These fractional contributions are applied to the total tributary sediment load to estimate sediment loads discharged from urban and non-urban land use types.

Sediment discharged from non-urban areas = 550 M kg / yr (range = 400 – 700 M kg/ yr)

Minimum = 600 M kg/yr x 70% = 400 M kg / yr (rounding to 1 significant figure).

Maximum = 1000 M kg/ yr x 70% = 700 M kg/yr

Sediment discharged from urban areas = 250 M kg / yr (range = 200 – 300 M kg/yr)

Minimum = 600 M kg/yr x 30% = 200 M kg/yr (rounding to 1 significant figure)

Maximum = 1000 M kg/yr x 30% = 300 M kg/yr

Mercury loads from non-urban areas = 80 kg/yr (range 20 – 100 kg / yr)

Minimum = 0.06 ppm x 400 M kg/yr = 24 kg Hg / yr (= 20 kg / yr rounded to 1 significant figure)

Maximum = 0.2 ppm x 700 M kg/yr = 140 kg Hg / yr (= 100 kg/yr rounded to 1 significant figure)

The best estimate taken at the midpoint of the range (before rounding) = 80 kg/yr.

Mercury loads from urban areas = 180 kg/yr (range 60 – 360 kg/yr)

Minimum = 0.3 ppm x 200 M kg/yr = 60 kg Hg/yr

Maximum = 1 ppm x 300 M kg / yr = 300 kg Hg / yr

The best estimate taken at the midpoint of the range (before rounding) = 180 kg/yr.

**Simplifying assumptions and resultant uncertainties
in stormwater loads**

The estimates of urban and non-urban mercury discharges suggest that while urban areas of the Bay discharge less sediment than open spaces, urban areas may discharge higher mercury loads than open spaces, because the concentrations of mercury in urban sediments are higher than non-urban sediments. That observation is predicated on the following assumptions:

- 1) The only uncertainty in predicting mercury concentrations in discharged sediments from bedded sediments is the particle size distribution of discharged sediments;
- 2) The relative amounts of sediment discharged from urban and non-urban areas have been accurately quantified by the rational method; and
- 3) The average mercury concentration in sediments and the average percent fines are good estimates of the expected values, as opposed to the medians.

The first assumption is not strictly true. Watershed processes introduce additional uncertainties that arise from using bedded sediments to predict the composition of discharged. The topography, land use, pollutant form and distribution, and fluvial geomorphology of a watershed affect the observed concentrations of pollutants in both bedded and discharged sediments. Thus, the observation that bedded sediments from urban storm drains have higher mercury concentrations than non-urban storm drains may be simply an artifact resulting from the type of sediment that deposits in urban storm drains. A monitoring approach to reduce this uncertainty would be to collect composite samples of storm events and directly characterize the mercury concentration and particle size distribution of discharged sediments. This is a labor-intensive approach, so the value of the reduced uncertainty should be carefully weighed against the cost of developing the information. The second assumption can also be tested with targeted watershed monitoring.

The third assumption is best addressed through a more sophisticated modeling approach. Rather than simply multiplying an average concentration times and average sediment load, it is better to develop the information needed to characterize the frequency distribution of mercury concentrations and sediment loads for different watersheds. Both distributions are expected to be log-normal (as with many environmental measurements). If a parameter (e.g., sediment load) varies systematically with flow, then it can be simulated for a long-term flow record to develop load estimates. If a parameter (e.g., concentration) varies randomly according to a log-normal distribution, the distribution can be simulated using a Monte-Carlo approach. The computations to implement such a method are fairly straightforward, but producing the data needed to develop the model is potentially a costly undertaking.

4.3 Wastewater Loads

Wastewater loads = 14 kg/yr (range 11 – 17 kg/yr)

Wastewater loads are measured as flow times annual average concentration, summed up over all dischargers. Best estimates are available in SFRWQCB staff reports that summarize NPDES self-monitoring data (Katen, 2001) (So, 2001). Those estimates have recently been updated [Larry Walker and Associates, 2003 #62]. The total is currently 12.2 kg/yr for municipal pollution control plants, and 2.0 kg/yr for industrial facilities. The overall loading to the Bay from combined municipal and industrial facilities is 14.2 ± 3.3 kg/yr. The range results from uncertainties due to interannual variation and propagated error from summing over thirty terms.

Simplifying assumptions and resultant uncertainties in wastewater loads

The only simplifying assumption in the calculation of wastewater loads of mercury is that analytical variability in measured mercury concentration is significantly smaller than monthly variability. Thus, the variance about monthly means was used to determine the uncertainty of individual facility load estimates. That sampling variance was propagated in the summation of all facility loads to generate the range for the total wastewater load estimate.

4.4 Direct Air Deposition

Direct Air Deposition = 30 kg/yr (range 10 – 50 kg/yr)

This means mercury deposited directly on the Bay surface. Airborne deposition over the watersheds is incorporated in the watershed loads. This has been measured by the RMP atmospheric deposition pilot study (Tsai and Hoenicke, 2001). The best estimate of direct deposition onto Bay totals 27 kg (=30 kg rounded to 1 significant figure), with likely range of 10-50 kg. The best estimate comes directly from report, and the range is inferred from “two-fold to five-fold” uncertainty stated in report (Tsai and Hoenicke, 2001).

Mercury can rapidly cycle in aquatic ecosystems between inorganic mercury, methylmercury, and dissolved gaseous mercury (discussed in subsequent sections). When dissolved gaseous mercury builds up in surface waters to concentrations above its saturation solubility, it can evade into the atmosphere, making surface waters a source to the atmosphere, rather than a sink. In San Francisco Bay, the atmospheric evasion rate for the entire Bay is estimated at 66 – 260 kg/ yr [Conaway, 2003 #63]. Considering the atmospheric deposition rate of 10 – 50 kg / yr, this means

that the net exchange of mercury between the atmosphere and the Bay is at least a 10 kg loss to the atmosphere, and could be as much as 250 kg per year.

**Simplifying assumptions and resultant uncertainties
in airborne deposition loads**

The rate of evasion from surface waters of the Bay is the major uncertainty in determining the net flux of mercury to or from Bay waters and the atmosphere. The estimates of mercury evasion rates are not very sensitive to atmospheric mercury concentrations, but are extremely sensitive to concentrations of dissolved gaseous mercury and wind speeds. Therefore, the best way to reduce the uncertainty about atmospheric loads cycling is to obtain more data on dissolved gaseous mercury in Bay waters and to use more detailed models of daily and average wind speeds.

Another major uncertainty is the fate of evaded mercury. How much of the 66 – 260 kg/yr of mercury evaded from the Bay deposits locally, to be cycled back into surface waters via stormwater runoff, how much is transported into the Central Valley, and how much escapes eastward of the Sierra Nevadas?

5. Mass Balance

Referring back to Figure 1, the size of the first five input terms has been estimated. Readily identified mercury inputs to the Bay total 700 kg/yr, with a possible range of 300-1100 kg/yr. To determine what else is missing, we can consider what is known about inputs-outputs and outputs to establish the boundaries of L, the “all other loads.”

5.1 Inputs – Outputs

If mercury inputs to the Bay exceed the outputs, then over time, the concentration of mercury in Bay sediments will be gradually increasing. If inputs are less than outputs, then mercury concentrations will decrease over time (one of the desired outcomes of a watershed management plan for mercury). If inputs are equal to outputs, then concentrations in sediments will remain the same. So we can make some preliminary judgments about the difference between inputs and outputs by asking, “how slowly is the concentration of mercury in Bay sediments changing?”

Year	[Hg] (mg/kg)
1993	0.34
1994	0.33
1995	0.23
1996	0.24
1997	0.31
1998	0.19
1999	0.31
2000	0.29

Table 2: Mercury concentrations in suspended particles of the northern reach of San Francisco Bay. Concentrations determined by simple linear regression of total recoverable mercury concentrations against TSS, with the intercept forced through zero.

The concentrations of mercury in suspended sediments of the northern reach over the past eight years are summarized in Table 2. Inspection of Table 2 suggests that the rate of change of mercury concentrations in sediments, ΔC_B , is no more than 0.01 mg/kg/yr and no less than -0.01 mg/kg per year. If the concentration of mercury in Bay sediments were changing faster than ± 0.01 mg/kg/yr, then we would expect a change of ± 0.1 mg/kg over the past decade; that does not appear to be the case. This qualitative statement can be better quantified through a more rigorous statistical approach, but it is still a useful starting point for constraining the mercury mass balance in San Francisco Bay.

Referring back to Figure 1, knowing that $-0.01 < \Delta C_B < 0.01$ helps constrain inputs-outputs, according to Equation 2

Equation 2:

$$(\text{Inputs} - \text{Outputs}) = \Delta C_B \times M_{\text{sed}}$$

Where M_{sed} is the mass of actively resuspended sediments (millions of kg)

The best estimate for the depth of the actively resuspended sediment layer is 0.15 m (Davis, 2002). The area of the Bay is $930 \times 10^6 \text{ m}^2$ (Conomos, 1979). Assuming that bedded sediments have a density of 1325 kg / m^3 , this means the mass of active sediments is 184,838 M kg:

$$M_{\text{sed}} = 0.15 \text{ m} \times 930 \text{ M m}^2 \times 1325 \text{ kg / m}^3 = 185,000 \text{ Mkg}.$$

If the average concentration of mercury in Bay sediments is 0.3 ppm, than the mercury mass inventory in the actively resuspended sediment layer is approximately 60,000 kg Hg. If the concentration of mercury in the actively resuspended sediment layer is changing by less than 0.01 ppm, then according to Equation 2 (and rounding to 1 significant figure):

$$- 2000 \text{ kg/yr} < (\text{Inputs} - \text{Outputs}) < 2000 \text{ kg/yr}$$

In other words, from the fact that the concentrations of mercury in Bay sediments are changing by less than 0.01 ppm per year, we infer that the 60,000 kg mercury mass inventory in the Bay is changing by less than 2000 kg/yr, or by less than 3% per year.

With a longer sampling period, the rate of change can be better constrained. For example, data from a 1970 assessment of mercury in the surface of San Francisco Bay sediments suggest that concentrations in surface sediments of the open Bay in 1970 were similar to contemporary concentrations [McCulloch, 1971 #64]. If the average concentration of mercury in Bay sediments has changed by less than 0.1 ppm over the past 33 years, then $- 0.003 < \Delta C_B < 0.003$, and therefore the 60,000 kg mercury mass inventory of the Bay would be changing by less than 600 kg/year (i.e., less than 1% per year).

5.2 Outputs

The outputs rates are determined by the rate of sediment removal from the Bay, primarily by tidal flushing out the Golden Gate and by disposal of dredged sediments to ocean or upland sites. Removal by burial is considered negligible, because the Bay does not appear to be accreting at a significant rate, and may in fact be eroding slightly (Jaffe et al., 2002) (Note that the erosion rate is still small, <1% compared to the total sediment flux through the Bay, so the steady-state approximation that sediment inputs balance sediment outputs is still valid). The total sediment load to the Bay, including the Central Valley and local tributaries, is between 1600 and 3200 M kg/yr. If the total amount of sediment leaving the Bay is roughly equal to the total amount of sediment entering the Bay, then at least 1600 and as much as 3200 M kg/yr of sediment also exits the Bay. If the average mercury concentration of sediments exiting the Bay is between 0.2 and 0.4 ppm, then the mass of mercury leaving the Bay via sediments is between 320 and 1280 kg/yr, with the best estimate taken at the midpoint (800 kg/yr).

Another possible removal pathway is evasion of dissolved gaseous mercury. As discussed above, this is estimated to be 66 – 260 kg/ yr [Conaway, 2003 #63]. Therefore, the total output rate for mercury in the mass balance model for the Bay is calculated to be between 390 and 1540 kg/yr, with a best estimate of 965 (=1000 kg/yr rounded to 1 significant figure)

5.3 Mass Balance

The total inputs inferred from the steady-state conditions of the Bay is calculated from Equation 3:

Equation 3:

$$\text{Total inputs} = (\text{inputs} - \text{outputs}) + \text{outputs}$$

Using the values for (inputs-outputs) and outputs calculated above, the best estimate for total mercury inputs to the Bay is 1000 kg/yr, with a likely range of -1600 kg/yr to 3500 kg/yr. This means that the net effect of all processes besides dredging, tidal flushing, and evasion to the atmosphere must be somewhere between an output of 1600 kg per year and an input of 3500 kg/yr, and that the best estimate is a net input of 1000 kg mercury per year to the Bay.

Assuming that all other outputs (burial, offgassing, upstream tidal mixing) are negligible, the implication is that total mercury loads to the Bay amount to 922 kg per year.

In comparison, loads to the Bay calculated from readily available data amount to 700 kg/yr. Therefore, the best estimate for all other loads (L, in Figure 1) is 300 kg/yr, with a likely range of -2700 - 3200 kg/yr. The results of the mass balance calculations (rounded to two significant figures) are summarized in Table 3.

6. Discussion of the Mass Balance

6.1 Summary of mass balance calculations

The results of this mass balance analysis can be summarized in a few intuitive statements that help determine the most important next steps to reducing uncertainties about mercury mass loads to the Bay. The initial approach treats the Bay as a single reservoir consisting of 185,000 M kg of sediment. The concentration of mercury in this sediment reservoir doesn't increase or decrease by more than 0.01 mg/kg per year, and the annual flow of sediment into the reservoir balances the annual flow of sediment out of the reservoir. For this simple system, annual mercury inputs of 940 kg/yr are required to balance the estimated mercury outputs. The sum of all direct estimates of mercury inputs is 640 kg/yr, suggesting that there are an additional 300 kg/yr yet to be accounted for.

However, there is a great deal of uncertainty associated with this estimate. The additional loads could be as much as 3000 kg/yr or as little as -2600 kg/yr (i.e., a net loss), based on a strict assessment of uncertainties associated with the mass balance calculation. The uncertainty comes from the approach - the sediment reservoir is massive (1.85×10^{11} kg), so limiting the rate of change in mercury concentration to 0.01 mg/kg/yr allows a difference of up to 1850 kg/yr between mercury inputs and mercury outputs.

	Hg Load, Best Estimate (kg/yr)	Hg Load, Possible Range (kg/yr)
Inputs		
Central Valley	400	240 - 630
Urban stormwater	200	60 - 300
Non-urban stormwater	80	20 - 100
Air Deposition	30	10 - 50
Wastewater	14	11 - 17
Total of Calculated Inputs	700	300 - 1100
Outputs		
Sediment loss	800	300 - 1300
Atmospheric Evasion	200	70 - 260
Total Outputs	1000	400 - 1600
Inputs-Outputs	0	(-2000) - 2000
Mass Balance		
Mass Balance Inputs = (Inputs - Outputs) + Outputs	1000	(-1600) - 3500
Additional loads = Mass Balance Inputs - Calculated Inputs	300	(-2600) - 3000

Table 3: Preliminary Mass Balance Summary for Mercury in San Francisco Bay. Data rounded to two significant figures.

6.2 Approach to reducing uncertainty in the mass balance

Much of this uncertainty can be reduced by just thinking about the system a little more carefully. It is extremely unlikely that total outputs have been underestimated by thousands of kilograms. For that to be true, it would require sediment burial rates, mercury offgassing rates, or biological uptake and removal rates that conflict with our present understanding of the biogeochemical cycle of mercury in the Bay. While this hypothesis should be more carefully reviewed by a science review team, it is worth considering what the more likely range for all other loads is if all other output processes total no more than 300 kg per year.

If the minimum values for all the estimated inputs shown in Table 3 are the true values, and additional output processes (i.e., gaseous evasion, biological uptake and removal, burial, disposal of dredged sediments) amounts to -300 kg, then the “additional loads” term would be no less than -514 kg/yr. On the other extreme, if there are no other significant outputs, the maximum values for all the estimated inputs shown in Table 3 are the true values, and the maximum values for all other possible loads (discussed in section 7 below) are added in, then the “additional loads” term would be no more than 1900 kg/yr.

So a more likely range for the “additional loads” term is (-514) – 1900 kg/yr.

Four general approaches are needed to reduce uncertainty in the mass balance:

- 1) *Improve direct estimates of mercury inputs in Table 3*
 - a. The true, long-term annual average concentration of mercury in sediments flushed into the Bay from the Central Valley, including variability during high-flow periods, is a key uncertainty that can be resolved through focused monitoring.
 - b. The amount of sediment discharged from urban and non-urban watersheds and the true, long-term annual average concentration of mercury in those sediments are additional uncertainties.
- 2) *Improve direct estimates of additional mercury loads discussed in section 7 below.*
 - a. Loads from the Guadalupe River are complicated by tidal mixing in the lower reaches of Alviso slough and Lower south Bay. This is a key uncertainty that can be resolved through monitoring and modeling.
 - b. Anomalous storm drain conveyances may contribute additional loads above those calculated using the “urban/non-urban” paradigm. This can be resolved through monitoring.
 - c. Benthic remobilization of polluted sediments deposited in deeper layers of the northern reach may be a substantial source. This can be resolved by collection of more cores throughout the Bay, and by modeling the sediment mixing and erosion dynamics.
- 3) *Refine the estimate for the rate of change in mercury concentrations of Bay sediments.*
 - a. The estimate for the rate of change in mercury concentrations can be improved reasonably soon by simply applying a more rigorous statistical approach to existing monitoring data. Such an approach should account for the heteroskedasticity of the regression analysis discussed in Appendix A.
 - b. Since the rate of change has time in the denominator, the estimate will improve as the time period of the monitoring data set gets longer.
- 4) *Refine the simple, one-box model to a multi-segment box model*
 - a. One key improvement to the mass balance model would be to improve the estimate for concentrations of mercury in sediments of different segments of the Bay. This can be done using data from a random, stratified sampling program, such as the EMAPS data set, or the redesigned approach of the RMP.
 - b. Another improvement is to break the mass balance calculations down into a multiple segment model, to more accurately reflect the segmented nature of San Francisco Bay. Such a model should account for both mixing and advection in the sediment transport dynamics of the Bay. A simple, two-segment conceptual model for the Bay is discussed in Appendix B.

Some preliminary work has been done on a five-segment mass transport box model for the Bay. This work should be peer reviewed and more rigorously tested. Initial results suggest that additional loads to the northern reach of the Bay, after accounting for stormwater, wastewater, airborne deposition, and loads from the Central Valley, amount to 100-500 kg per year, with a best estimate of 300 kg. For now, this range should be considered a working hypothesis, known as “The Adaptive Management Hypothesis.” This working hypothesis is based on Best Professional Judgment resulting from twelve years experience studying trace

metal geochemistry on San Francisco Bay, and two years of discussion with experts from the United State's Geological Survey, the San Francisco Estuary Institute, and the University of California. If greater precision is needed in the mass balance for mercury in San Francisco Bay in order to make key policy decisions, the hypothesis can be tested by addressing the four key uncertainties outlined above.

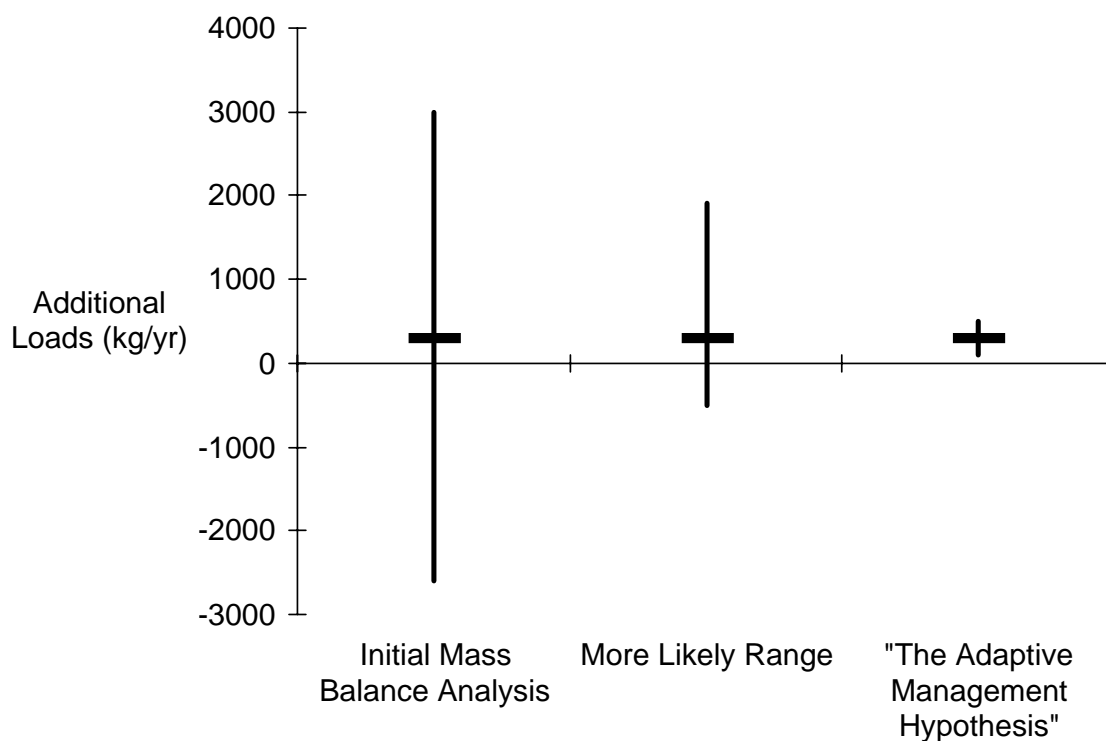


Figure 2: Closure on the mass balance (indicated by additional mercury loads) based on this initial mass balance analysis. The more likely range and the Adaptive Management Hypothesis indicate likely outcomes of improved monitoring and modeling efforts. Vertical lines indicate the range, horizontal lines indicate the best estimates.

7. Estimates of additional loads

7.1 Loads from the Guadalupe River

The mercury mines of the New Almaden mining district left the Guadalupe River watershed with a legacy of mercury-polluted sediments in piles of waste rock, surface soils, and stream sediments. The load resulting from this is calculated based on average mercury concentrations in sediments exported from the Guadalupe River watershed, and average annual sediment loads.

Hg Load from Guadalupe River = 100 kg/yr (Range 7-700 kg/yr)

= 5 mg/kg Hg in Guadalupe River Watershed sediments x 20 M kg sediment/yr

Average Hg concentration in sediments exported from Guadalupe River: We currently observe 1 mg/kg Hg in sediments at Alviso Slough during high flow (Abu-Saba and Tang, 2000), (Leatherbarrow et al., 2002), from data readily available through RMP annual reports and on SFEI website. However, Alviso slough is a bad place to estimate concentration of mercury in sediments leaving Guadalupe R. watershed because of tidal mixing – watershed sediments are diluted with Bay muds, hence 1 mg/kg is a lower limit. Sediments in the lower Guadalupe River near downtown San Jose have 2-10 mg/kg mercury. A reasonable estimate is 5 mg/kg, midway between 1 and 10. This estimate can be refined and substantiated from the wealth of sediment samples analyzed as part of the lower Guadalupe River flood control project. Kleinfelder Consultants also have an extensive data set from corings taken in conjunction with the Rivermark development project.

Sediment load from Guadalupe River : The “rational method” yields an estimate of 7 M kg/yr sediment (URS Greiner Woodward Clyde and Tetra Tech Inc., 1998). The rational method underestimates sediment load by 2-3 fold (Lester Mckee, personal communication). USGS used gauged flow and measured TSS and bed-load estimates to propose 36 – 74 M kg/yr (Porterfield, 1980). The best estimate is 20 M kg/yr, with a likely range of 7-70 M kg/yr.

7.2 Additional stormwater loads

Not all drainages within the Bay Area watersheds fit the “urban / non-urban” paradigm used to estimate stormwater loads. Sediments from some storm drain conveyances in the Bay Area have elevated mercury concentrations in the fine sediments compared to more typical urban and non-urban sediments [Gunther, 2001 #23] (**JASP report**). Of the over 200 samples collected for determination of mercury concentrations, 20 showed elevated mercury concentrations which did not fit the “urban / non-urban” paradigm. The average concentration of mercury (normalized to fine sediments) was 9 mg/kg, with a standard error of +/- 2 mg/kg. By making the very rough approximation that these anomalous watersheds represent about 1% of the watershed sediment load to the Bay, and assuming a likely range of 5-13 mg/kg (two times the standard error) for the concentration of mercury in these anomalous stormwater conveyances, the best estimate form mercury loads from other stormwater sources is 78 kg/yr, with a likely range of 22 – 126 kg/yr.

Sediment load from anomalous stormwater conveyances:

Best estimate = 7.1 M kg/yr = 0.01 x 707 M kg/yr (1% of watershed sediment load)

Minimum = 4.4 M kg/yr = 0.01 x 440 M kg/yr

Maximum = 9.7 M kg/yr = 0.01 x 970 M kg/yr

Mercury load from anomalous stormwater conveyances:

Best estimate = 9 mg/kg x 7.1 M kg/yr = 64 kg/yr

Minimum = 5 mg/kg x 4.4 M kg/yr = 22 kg/yr

Maximum = 13 mg/kg x 9.7 M kg/yr = 126 kg/yr

7.3 Loads from undetected local mines in the Northern Reach

There may be additional inoperative mercury mines in the Napa River watershed contributing to the loads for the northern reach. This is suggested by the map of inoperative mines in the 1995 Basin Plan. A reasonable first-order watershed assessment is possible simply by asking “are there possible places where 1-10 M kg/yr of sediment averaging 1-20 mg/kg mercury are discharged downstream?” If so, that could result in 1-200 kg/yr of sediment. Discharge of 5 M kg/yr sediment averaging 5 mg/kg would be 25 kg/yr. So the best estimate is taken as 25 kg/yr, with a likely range of 1-200 kg/yr.

The Gambonini mine in Marin County would be a good “calibration mine” to help think about this in greater detail, as well as site inspections and aerial photographs to identify potential sources of mercury due to erosion and mass wasting of tailings piles.

Mercury load from other mines in the Northern Reach:

Best estimate = 5 mg/kg x 5 M kg/yr = 25 kg/yr

Minimum = 1 mg/kg x 1 M kg/yr = 1 kg/yr

Maximum = 20 mg/kg x 10 M kg/yr = 200 kg/yr

7.4 Loads from sediment pulses from the Central Valley

Pulses of mercury-polluted sediments are transported downstream from mining-impacted watersheds during high-flow periods (Foe and Croyle, 1998; Ganguli et al., 2000; Leatherbarrow et al., 2002; Whyte and Kirschner, 2000). The concentration of mercury in sediments transported from the Central Valley may peak episodically during high-flow events, as a result of flushing from mining-impacted areas, as well as erosive scour of historically deposited sediments from within the Delta. Therefore, treating the observed 0.21 mg/kg concentration of mercury in sediments at Sacramento River mouth as a year-round average may be an underestimate. Even small departures from this average correspond to relatively large mercury loads, because the sediment load is so high during high-flow events.

For example, if 10% of the sediment load from the Central Valley had an average concentration of 0.31 mg/kg instead of 0.21 mg/kg, that would correspond to an excess of 21 kg over loads predicted from an annual average concentration of 0.21 mg/kg:

$$(0.31 - 0.21) \text{ mg/kg} \times (0.1) \times (2100 \text{ M kg/yr}) = 0.1 \text{ mg/kg} \times 210 \text{ M kg/yr} = 21 \text{ kg}.$$

Most of the sediment load from the Central Valley enters during high-flow periods (Foe and Croyle, 1998), so it is reasonable that up to 80% of the sediment load could have higher mercury

concentrations than the typically observed 0.21 mg/kg. This would suggest a maximum load of 168 kg from seasonal pulses out of the Central Valley:

$$(0.31 - 0.21) \text{ mg/kg} \times (0.8) \times (2100 \text{ M kg.yr}) = 0.1 \text{ mg/kg} \times 1680 \text{ M kg/yr} = 168 \text{ kg.}$$

The best estimate is taken at the mid-point, 95 kg/yr.

7.5 Loads from benthic remobilization

This is one of the hardest loads to estimate. Benthic remobilization refers to the gradual exposure of mercury – polluted sediments that were deposited over the past 100 years. Deep cores in San Francisco Bay show mercury concentrations up to 1 mg/kg in sediments beneath about 30 cm. The northern reach of San Francisco Bay was filled in up to 2 meters with sediment and debris from hydraulic mining in the late 1800's and early 1900's. Today, dams from the Central Valley Project have cut off considerable amounts of sediment supplied to San Francisco Bay, so the northern reach of the Bay has shifted from a depositional environment to an erosional one (Jaffe et al., 2002; Krone, 1979). As the Bay seeks to restore its natural bathymetry, polluted sediments from deeper layers are gradually mixed upward. This is probably the reason why we observe a concentration gradient between suspended particles and bottom sediments in the northern reach (Appendix 1), and may also explain in part why there is a mercury concentrations in sediments increase by about 0.1 mg/kg between the Sacramento River and San Pablo Bay.

Knowing that the other loads to the Bay add up to at most 284 kg, and that the total loads needed to close the mass balance are less than 1160 kg, it can be said that loads from exposure of polluted sediments are no more than 876 kg/yr.

8. Breakdown of the Central Valley Load

The Central Valley load can be subdivided into the watershed background load, the contribution from atmospheric deposition, mining legacies, and emissions from the urban environment.

8.1 Watershed background load

The concentration of mercury in sediments deposited in the Bay was 0.04 - 0.08 mg/kg in pre-settlement times (Hornberger et al., 1999). This pre-industrial watershed background was caused by mineral weathering and deposition of natural, pre-industrial atmospheric sources. The modern watershed background load has likely increased because the source of sediments has shifted. With the construction of dams and reservoirs, much of the sediment supply from the Sierra Nevadas was cut off from San Francisco Bay, resulting in a shift towards Coast Range sediments as the chief source. Coast range sediments likely have naturally higher average mercury concentrations, so we make the assumption that the modern background load due to mineral weathering is somewhat higher, about 0.06 – 0.10 mg/kg, with a best estimate of 0.08 mg/kg. Applied to the annual sediment load (1800-2400 M kg/yr), this implies a best estimate of 168 kg/yr, with a likely range of 108-240 kg/yr:

Best estimate = 0.08 mg/kg x 2100 M kg/yr = 168 kg/yr

Minimum = 0.06 mg/kg x 1800 M kg/yr = 108 kg/yr

Maximum = 0.10 mg/kg x 2400 M kg/yr = 240 kg/yr

8.2 Atmospheric Deposition over the Central Valley

Atmospheric deposition over the Central Valley probably accounts for between 0.05 and 0.15 mg/kg of the present day concentration of mercury in sediments discharged from the Delta. The upper limit, 0.15 mg/kg, comes from the average of two independent lines of evidence:

- i) Mercury concentrations in the upper layer of sediments collected from Lake Tahoe average around 0.2 mg/kg. Lake Tahoe is an alpine Lake in the Sierra Nevadas (Slotton, 2000). Mercury loads to the lake are essentially all atmospheric in origin – there are no known mercury or gold mines in the Lake Tahoe Basin. In deeper, dated cores, collected from the lake, background concentrations were approximately 0.04 mg/kg. Therefore, the inferred effect from modern atmospheric deposition is 0.16 mg/kg. Deposition rates appear to be much higher in the high Sierras than on the California Coast, and dams downstream trap sediments, so the effect of air deposition on mercury concentrations in Central Valley sediments is probably lower than what we see in the Sierras.
- ii) The median mercury concentration is also around 0.2 mg/kg for surface background sediments collected throughout the Central Valley (Bradford et al., 1996). Since the

natural background of this sediment is 0.06 mg/kg, we infer an effect of 0.14 (=0.2 – 0.06) mg/kg from atmospheric deposition onto the Central Valley.

The best estimate of the lower limit is 0.05 mg/kg. This estimate assumes that since contemporary global atmospheric mercury emissions are 2-3 fold greater than in pre-industrial times, atmospheric deposition must have some effect on the concentration of mercury in surface sediments. Therefore, the lower limit is set by the observation that even in remote areas of the world atmospheric deposition increases mercury concentrations in soils by 0.05 mg/kg (Fitzgerald et al., 1998).

Given these upper and lower limits, atmospheric deposition probably elevates mercury concentrations in Central Valley Sediments by 0.10 +/- 0.05 mg/kg compared to pre-industrial times. Applied to the estimated sediment load from the Central Valley, this suggests a best estimate of 210 kg/yr, with a likely range of 90 – 360 kg/yr.

Best estimate = 0.10 mg/kg x 2100 M kg/yr = 210 kg/yr

Minimum = 0.05 mg/kg x 1800 M kg/yr = 90 kg/yr

Maximum = 0.15 mg/kg x 2400 M kg/yr = 360 kg/yr

8.3 All other Central Valley Sources, including inoperative mines

With an estimate of the total mercury load discharged from the Central Valley, and estimates of the amount of that load cause by mineral weathering and atmospheric deposition, the load from all other sources, including inoperative mercury mines, can be estimated by difference. Mineral weathering plus atmospheric deposition account for at least 0.11 mg/kg, and may account for almost all of the 0.21 mg/kg mercury concentration observed in Central Valley sediments. Thus, the impact of discharges from all other Central Valley sources, including inoperative mercury mines, urban runoff, and wastewater, is between 0.01 and 0.10 mg/kg.

This yields a possible range of 18 – 240 kg for all other Central Valley sources:

Minimum: 0.01 mg/kg x 1800 M kg/yr = 18 kg/yr

Maximum: 0.1 mg/kg x 2400 M kg/yr = 240 kg/yr


Best estimate: 441 kg/yr (Central Valley Total) – 210 kg/yr (Best estimate for air deposition) – 168 kg/yr (best estimate for mineral weathering) = 68 kg/yr

	Hg Load, Best Estimate	Hg Load, Possible Range	[Hg]sed	Sediment Flux
Mineral Weathering	168	108 - 240	.06 - .10	1800 - 2400
Air Deposition	210	90 - 360	.1 - .2	1800 - 2400
All other Central Valley Sources, including mines	63	1 - 243		
Total	441			

Table 4: Breakdown of estimated loads contributing to total Central Valley load.

Appendix A: How we know what we know about mercury concentrations in Bay sediments

The basis for calculating a Total Maximum Daily Load for mercury in San Francisco Bay is the concentration of mercury in sediments. Like many pollutants, mercury preferentially partitions onto sediments. In the Bay, for every atom of mercury in the dissolved phase, there are about a million mercury atoms stuck to particles¹. So, even though the Bay is a complex, tidally mixed estuary with multiple mercury sources, we can simplify the mass balance problem by just considering mass transport of mercury in the particulate phase:

$$\begin{array}{ccccc} \text{Hg load} & & & & \text{Sediment load} \\ \text{(kg Hg / yr)} & = & \text{Concentration in} & \times & \text{(M kg sed / yr)} \\ & & \text{sediments (ppm,} & & \\ & & \text{mg Hg / kg sed)} & & \end{array}$$


Equation 4: Relationship between mercury loads, mercury concentrations in sediments, and sediment load.

The power of the “view from downstream” is its simplicity. By asking “what causes the contemporary observed concentrations of mercury in receiving water sediments,” we are led to some rather straightforward measurements of mercury concentrations in sediments in different parts of the Bay and its watersheds. The purpose of this memo is to explain how we analyze the thousands of data points from the RMP¹ to quantify the concentration of mercury in Bay sediments.

¹ This is quantitatively expressed as the partition coefficient:

$$K_d = \frac{10^6 \times ([\text{Hg}]_{\text{tot}} - [\text{Hg}]_{\text{diss}})}{[\text{Hg}]_{\text{diss}} \times \text{TSS}} \quad (\text{L/kg})$$

Values for total mercury in water ([Hg]_{tot}), dissolved mercury ([Hg]_{diss}) and total suspended solids (TSS) are available from the Regional Monitoring Program, at www.sfei.org. The K_d for Mercury in the Bay ranges from 100,000 – 10,000,000 L/kg, and is most commonly on the order of 1,000,000 L/kg.

A.1 Available Data

The data set for making these determinations comes from the RMP, which archives the data for public access at www.sfei.org. Data are available for sampling cruises conducted between 1993 and 2000. Subsequent data have been collected, but have not been reviewed and approved for release yet. Much of the Hg data from later years (1999 and 2000) has been “blank flagged,” indicating they should be considered with caution, because the contracting laboratories reported high blanks ($<30\%$ of sample signal)² in their analyses that year. The analyses for this study were conducted both by using the full 1993-2000 data set and by deleting “blank-flagged” data. The conclusions are not affected by removing the blank flagged data, so all discussions are based on the full data set.

The United States Environmental Protection Agency has also collected a survey of pollutant concentrations in Bay sediments (their EMAPS program). The EMAPS survey used a random stratified sampling design to choose station locations. When this data becomes available, it will be a useful check as to whether sample design affects the conclusions. Until then, what we know “now” is established by the RMP data set.

There are two types of measurements available in the RMP data set: water column and bottom sediments. This analysis uses both. Water column measurements are collected by pumping water from approximately one meter below the water surface into sample bottles. Samples are analyzed for total recoverable mercury (i.e., the concentration of mercury in an unfiltered water sample after it has been acidified to $\text{pH} < 2$). Water column measurements also quantify the total suspended solids (TSS) in a sample. Total recoverable mercury and TSS measurements are combined to make inferences about the concentration of mercury in suspended sediments. Bottom sediment samples are collected by dropping an Eckman dredge overboard to collect a large (about 1 m^3) chunk of the Bay floor. The top five centimeters of sediments in the dredge are homogenized and analyzed for total mercury and grain size (i.e. the percent fine material, less than 63 microns). Total mercury and percent fines measurements are combined to make inferences about the concentration of mercury in fine bottom sediments.

² The fact that the blank flags went up is a sign that the QC program is working.

A.2 Data analysis: Basic calculations

Analysis of both the water column and the bottom sediment data relies upon simple linear regression to make scientific inferences about mercury concentrations in Bay sediments. This approach yields not only estimates of mercury concentrations, but also reasonable descriptions of the uncertainty of those estimates. We have to use regression analysis because for both water column data and bottom sediment data, there are gross physical processes that affect observed mercury concentrations. Total mercury in the water column tends to increase with increasing suspended load. Total mercury in bottom sediments tends to increase when sediments have more fine material. We “normalize” water column data to suspended load and bottom sediment data to percent fines in order to detect differences in mercury concentrations that are due to mercury loads.

For the water column data, we plot total recoverable mercury against TSS. The slope of the best fit line gives the average concentration of mercury in the suspended particulate matter, according to .

$$[\text{Hg}]_{\text{sediment}} (\mu\text{g/g, mg/kg}) = [\text{Hg}]_{\text{water}} (\mu\text{g/L}) / [\text{TSS}] \text{ mg/L} \times 1000 (\text{mg/g})$$

Equation 5: Water column mercury concentrations ($[\text{Hg}]_{\text{water}}$) as a function of mercury concentrations in sediments ($[\text{Hg}]_{\text{sediment}}$) and suspended load ($[\text{TSS}]$).

Equation 5 simply expresses the slope of the regression line as the rise over the run, and performs the unit conversion to get the answer in $\mu\text{g Hg}$ per g of suspended sediment. This is the basic calculation to determine mercury concentrations in suspended particles. The complete analysis also considers segmentation of the Bay and uncertainty of the basic calculation, as discussed below. For now, the important point is that for the water column data, we use regression analysis to determine a slope, and that slope has physical meaning. We are looking at a data set and asking, “given the observed relationship between total mercury in the water column and suspended sediment concentration, what does that tell us about the average concentration of mercury in the suspended sediments?”

When using simple linear regression, we can choose to calculate the intercept (Figure 3—A), or to force the intercept through zero (Figure 3-B). Our basic assumption is that essentially all the mercury is in the particulate phase, so the water column mercury should be zero at zero suspended load. This suggests that the best approach for the regression analysis is to force the intercept to zero. This makes use of known information and reduces the effect of high relative uncertainty at low suspended loads. The forced intercept approach (Figure 3-B) is used consistently for all regressions in this analysis, but the results are always compared to the calculated intercept approach (Figure 3-A) to see if the conclusions change with the statistical model selected.

For the bottom sediment data, we plot total recoverable mercury against percent fines, and then calculate mercury concentration where the best fit line crosses the Y axis at 100%. This is slightly different than the approach to the water column data, because we are working in different media. In the case of sediments, we are looking at a data set and asking, “given the observed relationship between mercury in sediments and the percentage of fine material present, what is the inferred concentration of mercury in just the fine sediments?”

The underlying assumption is that all of the mercury in bottom sediments is stored in the fines, and none in the sandy material. This turns out to be a reasonable assumption for Bay sediments, but not necessarily in the watersheds. The reason the two cases are different is that the watersheds are truly dynamic, whereas Bay sediments are at dynamic equilibrium. Large chunks of cinnabar rolling down the Guadalupe River watershed can substantially elevate mercury concentrations in coarse sediments. But large chunks tend to drop out in the depositional reaches of the lower watershed, where they are ground and weathered into smaller particles that are tidally mixed into the Bay. Within the Bay, mercury is constantly adsorbing to and desorbing from particles – the observed partition coefficient is a dynamic equilibrium. There is statistically a much greater chance that an adsorbing mercury atom will hit the surface of a fine particle than a coarse one, because of surface area to volume ratios. This could be demonstrated using a complex statistical mechanical approach, but it is far simpler to plot mercury concentrations vs. grain size and note that in the Bay, the concentration approaches zero as the percent fines approach zero.

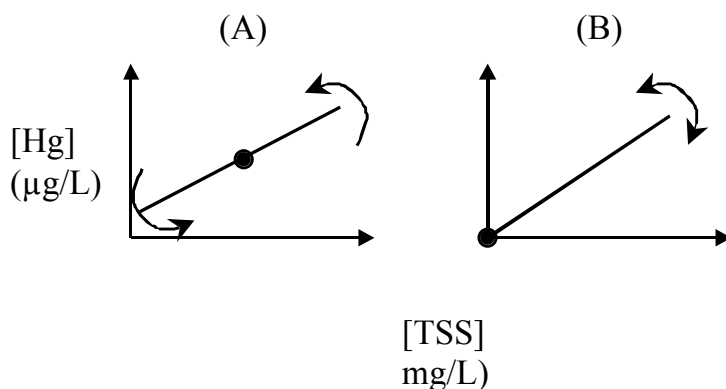


Figure 3: Regression analysis can either calculate the intercept, in which case the best fit line pivots around the centroid of the data (Case A) or force the intercept, in which case the best fit line pivots around the intercept (Case B).

As with the water column data, the regression analyses of bottom sediments consistently force the intercepts through zero, but compare the results to the unforced calculations to see if the conclusions change with the statistical model used. The basic calculations used to determine mercury concentrations in suspended and bottom sediments are compared in Figure 4.

Concentrations can be compared between media (suspended and bottom sediments) by making the assumption that suspended sediments are 100% fine (< 63 microns). This is a reasonable assumption, given that coarse sediments tend to rapidly drop out of suspension. Concentrations determined by this method can also be compared to historic concentrations measured in deep cores by the USGS. Sediments from those cores were sieved to less than 63 microns prior to analysis, so the measurements published by Hornberger et al (1999) reflect mercury concentrations in 100% fine sediments.

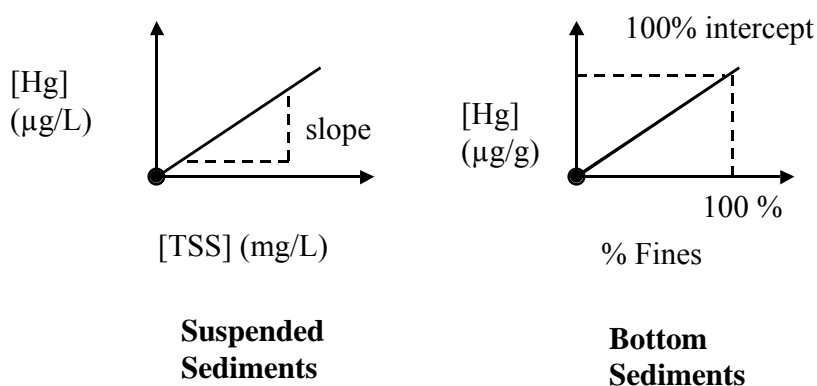


Figure 4: Comparison of regression approaches to determine mercury concentrations in suspended sediments and bottom sediments.

A.3 Data analysis: Segmentation of the Bay

The next step is to divide the Bay into segments in order to identify whether there are spatial gradients in the concentration of mercury in Bay sediments. The conceptual basis for segmenting the Bay is discussed in Appendix 2). For this discussion, the Bay is divided into four segments: Suisun Bay, San Pablo Bay, Central Bay, and South Bay. South Bay refers to the portion of the Bay between the Dumbarton Bridge and the Bay Bridge. Lower South Bay (south of the Dumbarton Bridge) is a unique environment. Because of the large concentration gradients observed in some contaminants, it is more appropriate for this analysis to regard Lower South Bay as an interfacial region between the South bay watersheds and the Bay, rather than a segment of the Bay. Data from Suisun Bay, San Pablo Bay are also combined to describe a segment called “the northern reach.” The nomenclature for RMP stations makes it possible to quickly sort a data set by station code and divide the data into segments (Table 5).

Segment	RMP Stations
South Bay	BA10, BA20, BA30, BA40, BB15, BB30
Central Bay	BB70, BC10, BC20, BC30, BC41, BC60
San Pablo Bay	BD15, BD20, BD30, BD40, BD50, BD60
Suisun Bay	BF10, BF20, BF30, BF40
Sacramento River	BG20
San Joaquin River	BG30

Table 5: Segmentation of the San Francisco Bay estuary by RMP station code.

The Sacramento River station (BG20) is used to make assessments about the concentrations of mercury entering the estuary from the Sacramento – San Joaquin River delta. Because this is a tidally mixed interface region, this assumption needs to be considered with some caution – some of the observed concentrations at BG20 are due to tidal mixing of fluvial sediments with sediments already in the estuary. This is an acknowledged uncertainty that is discussed in greater detail elsewhere (Memo-2). For this analysis, it is sufficient to state that BG20 gives us our best approximation for the concentration of mercury in sediments flushed into the Bay from the Delta.

The San Joaquin River station (BG30), while nominally in the San Joaquin River, doesn't necessarily reflect the nature of sediments entering the Bay from the San Joaquin river basin, because flows through the Delta are extremely complex in this region. BG30 appears to be a depositional region, because the sediments in this region typically have more fine material compared to BG20. This station has some unusual properties that raise some interesting questions about the concentration of mercury in sediments originating from the Delta, but those details are beyond the scope of this discussion.

Results

	South Bay	Central Bay	Northern Reach	San Pablo Bay	Suisun Bay	Sac River
<i>(Forced intercept)</i>						
Surface	0.48 +/- 0.02	0.34 +/- 0.01	0.26 +/- 0.01	0.26 +/- 0.01	0.26 +/- 0.01	0.21 +/- 0.01
Bottom	0.37 +/- 0.11	0.32 +/- 0.07	0.36 +/- 0.08	0.37 +/- 0.09	0.31 +/- 0.06	0.34 +/- 0.03
<i>(Calculated Intercept)</i>						
Surface	0.45 +/- 0.02	0.26 +/- 0.01	0.24 +/- 0.01	0.23 +/- 0.01	0.23 +/- 0.02	0.20 +/- 0.02
Bottom	0.34 +/- 0.10	0.30 +/- 0.07	0.35 +/- 0.08	0.36 +/- 0.09	0.31 +/- 0.06	0.30 +/- 0.03

Table 6: Summary of regression analyses of RMP from San Francisco Bay segments. Surface concentrations refer to the slope of the best fit line for a plot of total water column mercury vs. TSS. Bottom concentrations refer to the 100% intercept of the best fit line. Uncertainties show one standard error. All calculations were done using the LINEST function of Microsoft EXCEL.

Two general trends emerge from the data analysis (**Table 6**). First, mercury concentrations in surface sediments tend to increase as we move from the Sacramento River mouth, through the northern reach, and into Central and South Bay. This is true regardless of whether or not we do the regression calculations with a forced intercept. Second, mercury concentrations are higher in bottom sediments than in surface sediments in the northern reach, are roughly comparable in the Central Bay, and higher in the surface than at the bottom in the South Bay. This is also true regardless of whether or not the regression calculations force the intercept. *The observed north-south and surface-bottom gradients provide important clues about sediment transport and mercury loads to San Francisco Bay.*

The data from **Table 6** are combined and summarized in a conceptual model (**Figure 5**). One important clue that emerges from the conceptual model is that the concentration of mercury in sediments increases by about 0.1 mg/kg between the Delta and San Pablo Bay. This increased concentration can be used to put an upper limit on the internal loads of mercury to San Francisco Bay.

The top-bottom gradient probably reflects the different depositional environments of the northern and southern reaches. In the northern reach, a massive plug of mercury-laden sediment was deposited during and after the gold rush. That plug is being gradually exposed as the Bay seeks to attain its natural bathymetry. The South Bay isn't really erosional or depositional – sediments washed in from surrounding watersheds just slosh back and forth until they are tidally mixed out the Golden Gate. So the insult from the New Almaden mine isn't buried deep in the sediments of South Bay. Past and present mercury loads to South Bay are stored in the active layer, where they are continuously deposited, mixed with deeper, cleaner sediments, and then resuspended. This is most likely the reason that the top-bottom gradient is reversed in South Bay.

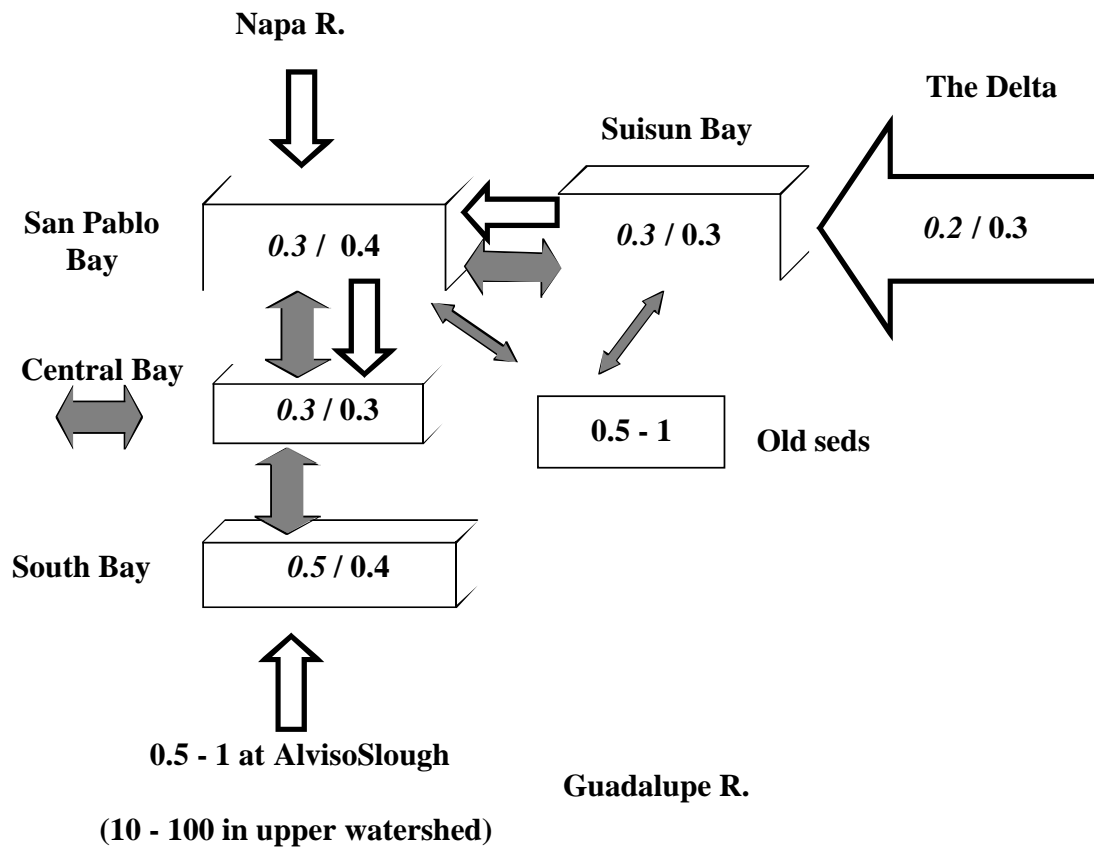


Figure 5: Conceptual model for sediment transport processes affecting the concentration of mercury in San Francisco Bay sediments. Single white arrows indicate advection, double dark arrows indicate mixing. Italicized numbers indicate suspended sediment concentrations, bold-faced numbers indicate bottom sediment concentrations.

Appendix B: Conceptual model for segmenting the Bay

Detailed analysis of Bay loads required breaking the Bay into segments. A good starting point is to consider the Bay as two distinct segments, the northern reach and South Bay, which are joined at Central Bay (Figure 6). This conceptual model is warranted because the hydraulic and sediment transport processes are different in the northern reach compared to South Bay. In the northern reach, the dominant transport mechanism for sediments is river flow. Although tidal action is significant in the Delta, there is still a strong net tidal residual transport in the downstream direction up to the Carquinez straits. From San Pablo Bay to the Golden Gate, the dominant transport mechanism shifts to wind and tidal mixing. Sediment transport out of the South Bay is predominantly by wind and tidal mixing.

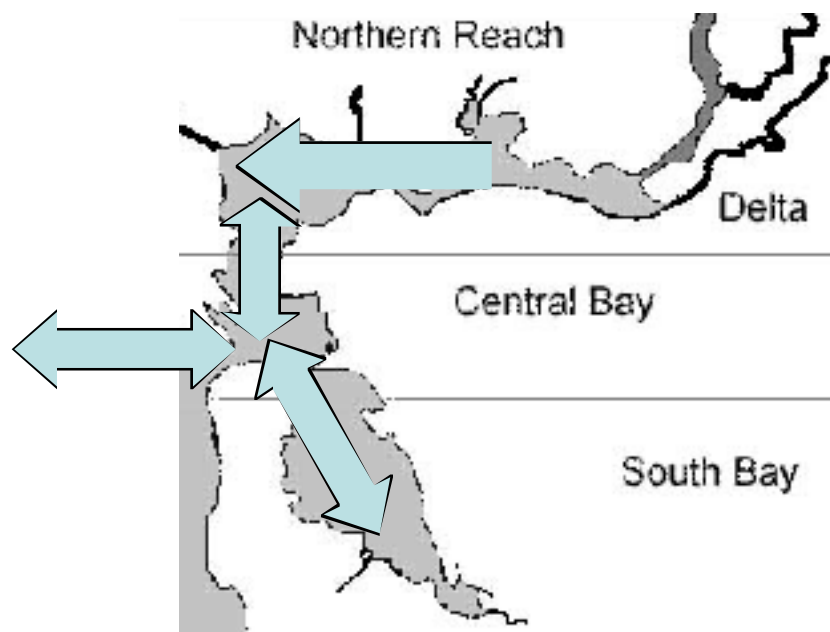


Figure 6: Conceptual model for sediment transport dynamics in the Bay, treated as a three-segment system. Single arrows indicate sediment transport that is predominantly advective, double arrows indicate sediment transport that is predominantly wind and tidal mixing.

In summary, the way the Bay works is that sediments are flushed in from the Central Valley, through the Delta, and into San Francisco Bay by predominantly advective forces. In the northern reach, sediments are deposited on the bottom, mixed with deeper sediments, and resuspended. Transport of sediments out of the northern reach is by tidal mixing. In the South Bay, transport is exclusively by wind and tidal mixing. This is an extremely simplified description of a complex superposition of processes, including seasonally variable freshwater outflow, spring-neap variability in suspended load inventories, mixed tidal and fluvial transport,

and wind-driven mixing and circulation. These processes are the focus of ongoing research, all of which has been considered or relied upon to develop this simplified conceptual model (Schoellhamer, 1996 May 15), (Cappiella et al., ; Conomos, 1979; Conomos et al., 1985; Schoellhamer, 2001; Smith, 1987) [U.S. Environmental Protection Agency, April, 1996 #24; Walters, 1985 #25] (Cheng et al., 1993). Although it is a complicated subject, the essential points of the science needed to understand the generalized conceptual model for sediment transport, mixing and dynamics in the Bay illustrated in Figure 6 are captured by Figure 7 and Figure 8.

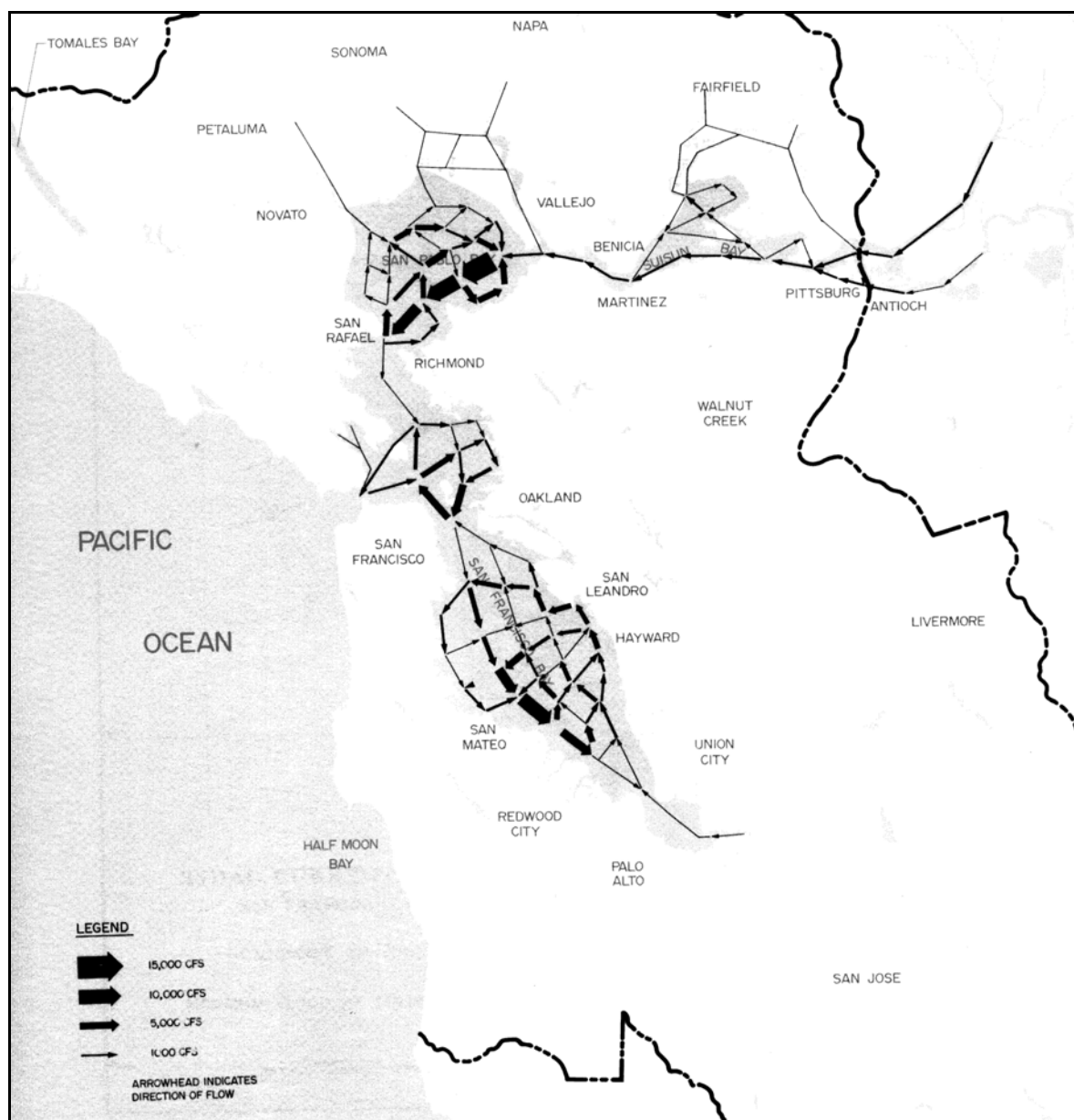


Figure 7: Flow and circulation of San Francisco Bay. Figure taken from (San Francisco Bay Regional Water Quality Control Board, 1975).

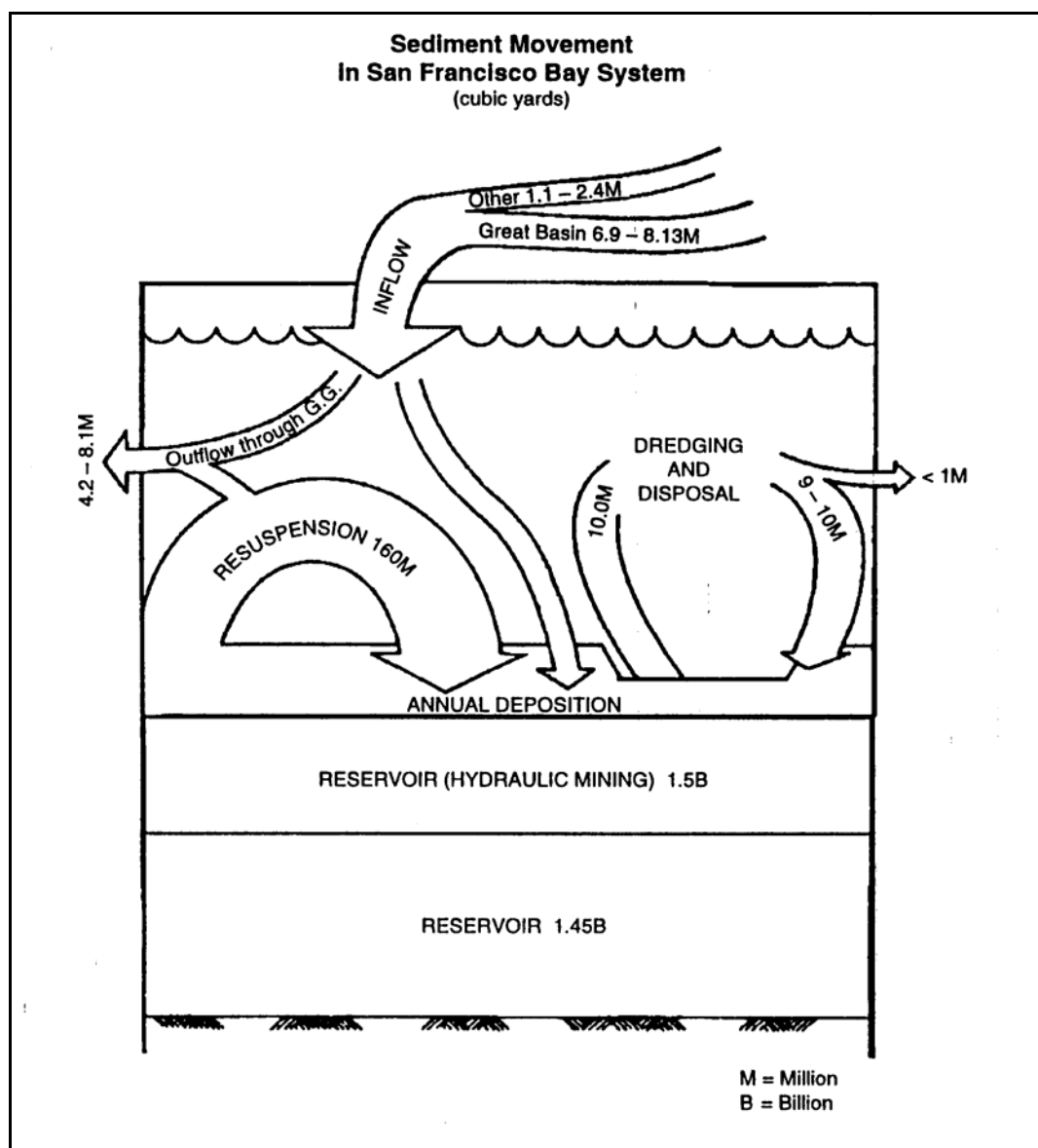


Figure 8: Annual sediment budget for San Francisco Bay. Figure taken from [U.S. Environmental Protection Agency, April, 1996 #24].

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 AB: The history of mercury in California is recorded in the sediments of San Francisco Bay. The Bay is downstream of 40 percent of the land area of California. Its watershed receives 80 percent of the rainfall in the State, because it rains more in the north. Three billion kilograms of sediments are annually flushed from the Central Valley watershed and deposited in San Francisco Bay. Because mercury preferentially binds to sediments, we calculate mercury loads to the Bay by considering how various sources affect mercury concentrations in Bay sediments. During and after the Gold Rush, over seventy thousand tons of mercury was produced in Coast Range cinnabar mines. Much of this mercury was used as quicksilver to extract gold from placer formations in the Sierra foothills, and later in the production of munitions, electronics, health care and commercial products. Today, we can see the legacy of mining sources, from both remote and local watersheds, superimposed on air deposition, the climate and geography of California, heavily managed water supply and flood control projects, wetland restoration and rehabilitation, urbanization, wastewater discharge and water reclamation. We already regulate wastewater and urban runoff through issuance of permits and waste discharge requirements. We can regulate mercury inputs from inoperative mines by demonstrating the link between mercury-polluted sediments and violation of existing numeric water quality objectives. We can use the same

approach to regulate the disposal of mercury-containing electronic devices. But to reduce mercury levels in fish, we will also have to consider controllable water quality factors that promote mercury methylation in the aquatic ecosystem. Some of these water quality factors are already subject to regulation. For example, we can show that mercury methylation in the northern reach of the Bay increases when dissolved oxygen drops below 6 mg/L; current regulations require dissolved oxygen concentrations of 7 mg/L or more in that region. But many of the processes that influence mercury bioaccumulation, such as microbial assemblage, sulfate concentration, and organic carbon loading, are complex, interacting factors that cannot be expressed as simple numeric limits. The Water Quality Control Plan for San Francisco Bay has a narrative objective for bioaccumulation that states that "controllable water quality factors shall not cause a detrimental increase in the concentrations of toxic substances found in bottom sediments or aquatic life." To effectively implement that objective, we need basic science research to develop sound guidance for the creation, restoration, and management of wetlands and marshes surrounding the Bay.

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Mercury Management by Bay Area Wastewater Treatment Plants

Approaches, costs, and benefits of alternative scenarios for implementing the San Francisco Bay TMDL mercury in municipal and industrial National Pollutant Discharge Elimination System (NPDES) permits.

Prepared by

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and

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September 11, 2003

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Executive Summary

This report summarizes the approaches and feasibility of mercury management strategies for Bay Area wastewater treatment plants. It begins with an assessment of current mercury loads, predicts future (2025 A.D) loads based on population growth, and then evaluates the costs and benefits of different load management strategies. In addition to mercury load management strategies, factors affecting the feasibility of capturing and treating stormwater and managing mercury methylation in shallow waters are also discussed.

The current mercury load to the Bay from wastewater treatment plants is 15 +/- 3 kg/yr, (13 kg from municipal facilities, 2 kg from industries). This amounts to approximately 1 - 2% of the total mercury load entering the Bay (1200 kg / yr). Based on growth projections for the Bay Area, this load is predicted to increase to 17 kg/yr by the year 2025, absent any new mercury load reduction measures.

Implementation of pollution prevention and source control projects could reduce the future load from 17 kg/yr to 11 - 16.5 kg/yr, at a cost of \$8 million - \$25 million/yr. This represents an upper limit for both the costs and expected benefits of pollution prevention and source control, as these programs are already substantially implemented throughout the Bay Area. Combining pollution prevention with limited (Stage 1) increases in water reclamation would limit the future load to 10 - 14 kg/yr, at a cost of \$87 - 104 million/yr. More extensive water reclamation (Stage 2) would limit the future load to 8 - 12 kg/yr, at an annualized cost of \$247 - \$267 million. Upgrading all existing secondary plants (including industrial facilities) to include filtration would constrain the future mercury load to < 7 kg/yr, at a cost of \$167 - \$404 million/yr, and installation of reverse osmosis treatment on all Bay Area wastewater facilities would reduce the future mercury load to < 3 kg/yr at a cost of \$917 - 934 million/yr.

The feasibility of capturing and treating stormwater is very site-specific, depending on the ability to match catchments with highly polluted sediments with nearby excess treatment capacity. For mercury alone, the approach may not produce significant load reductions: in an example from an industrial catchment in Oakland, the projected load reduction for a significant engineering project would amount to 0.1 - 0.4 kg/yr of mercury, while consuming up to 6 mgd of capacity and requiring storage of 2.2 billion gallons. The feasibility of such a project could be enhanced if additional stormwater pollutant loads, such as PCBs or legacy pesticides, were considered. However, there are substantial technical and public policy barriers to blending urban runoff with sewage.

Strategies to reduce conversion of mercury to methylmercury may ultimately be more effective at reducing mercury concentrations in Bay fish. The final section discusses the need for an assessment of which mercury sources are most readily "methylated," how dissolved oxygen management could affect methylation rates, and whether other aspects of treatment plant operation, such as nitrification or the choice of flocculant, can affect mercury methylation in receiving waters.

1. Background

The Clean Estuary Partnership, in support of the Regional Board's development of a Total Maximum Daily Load and Implementation Plan for mercury in San Francisco Bay, has authorized production of this report to answer specific questions regarding mercury management alternatives for municipal and industrial wastewater treatment plants. In order to provide reasonable assurance that wastewater discharges of mercury do not impair beneficial uses such as fishing and wildlife habitat, the Regional Board needs to know:

- 1) What is the current mercury load discharged to the Bay from wastewater?
- 2) In the absence of significant infrastructural and programmatic changes, how much will that load increase as a result of increased effluent flow due to population growth over time?
- 3) What benefit would additional infrastructural and / or programmatic mercury control measures have on the mercury load from wastewater discharges?
- 4) What are the expected costs of infrastructural and programmatic mercury control measures?
- 5) What additional management actions are possible that might reduce the conversion of mercury to methylmercury in receiving waters?

From the initial public review of the draft mercury strategy for managing mercury in the northern reach (Taylor, 1998), to the Mercury TMDL preliminary project report (Abu-Saba and Tang, 2000), to the Mercury TMDL final project report (Looker and Johnson, 2003), two important findings have emerged regarding mercury management alternatives for wastewater. First, it is clear that the mercury load to the Bay is dominated by watershed sources, such as mining-impacted watersheds and atmospheric deposition. The latest assessments quantify mercury loads from wastewater as 14.7 kg/ yr, compared to 1220 kg per year from all sources. Second, mercury management needs to address mercury bioaccumulation, because the beneficial uses impaired by mercury are related to mercury concentrations in fish. For mercury, this means looking for ways to reduce the formation of methylmercury in receiving waters, because this is the form that accumulates in fish. This report discusses management of mercury loads from wastewater in the context of those two findings.

Section 2 documents the approach to calculating wastewater loads from municipal and industrial treatment plants. This information was directly relied upon in the development of the Mercury TMDL final project report. A periodic update of Section 2 would be a useful mechanism for the Regional Board to track individual and aggregate mercury loads over time, providing reasonable assurance that the TMDL load allocation for wastewater is attained.

Section 3 analyzes the effect of population growth on the mercury load from wastewater, in the absence of any new infrastructural or programmatic mercury controls (i.e., the “no-action” alternative). Section 4 combines the information from Sections 2 and 3, along with cost and load reduction estimates, to summarize the costs and expected benefits for different load management scenarios. This analysis is important to fulfill the Porter-Cologne requirement (Sec. 13241 and 13242) to consider the need for communities to grow and develop new housing when the Regional Board adopts plans to implement water quality standards.

Section 5 describes site-specific factors that need to be considered to evaluate the feasibility of routing urban stormwater through municipal pollution control plants in order to control mercury loads. Section 6 describes monitoring and infrastructural approaches to managing mercury methylation in receiving waters.

The last two sections are adaptive management components of TMDL implementation for wastewater treatment plants. While there is a relatively high degree of certainty about current and future mercury loads from wastewater, and the costs associated with managing those loads, there is a great deal of uncertainty as to whether the benefits of treating stormwater are commensurate with the economic and societal costs, and the extent to which decisions about the operation of wastewater treatment plants can affect mercury methylation in receiving waters. Sections 5 and 6 describe some of the key factors to be considered to resolve these questions.

2. Updated mercury annual load estimates and annual average effluent concentrations for municipal and industrial wastewater treatment facilities

2.1 Purpose

Establish current baseline loading from municipal and industrial wastewater point sources for use in the mercury TMDL and wasteload allocation analysis.

2.2 Background

Loads were originally estimated in the Mercury TMDL preliminary project report (Abu-Saba and Tang, 2000). Estimates of mercury load from wastewater treatment facilities as outlined in that report ranged from 25 to 63 kilograms per year. It was acknowledged that those estimates were based on a limited set of reliable mercury effluent concentration data. For a number of the treatment facilities considered in that analysis, available data had been collected using an inadequate USEPA analytical method with a method detection limit of 200 nanograms per liter (ng/l). Such data have been shown to significantly overestimate actual mercury concentrations in treated effluent.

Recognizing this deficiency, the Regional Board required that all Bay area facilities begin collecting mercury data using a newly adopted USEPA analytical method (Method 1631) in January 2000 (SFRWQCB, 1999). The detection limit for the new analytical

method was less than 1 ng/l. A preliminary report and statistical analysis using all available method 1631 mercury data for Bay area treatment plants was compiled by Regional Board staff (SFRWQCB, 2001). In that report, data distributions for secondary and advanced treatment facilities were developed. In support of the mercury TMDL that will be considered by the Regional Board, an updated estimate of mercury annual loadings based on a larger data set of Method 1631 data is desired. Thus, using data provided by the Bay Area pollution control plants and statistical tools developed by Regional Board staff (SFRWQCB, 2001), this type of regional update can be implemented from time to time (i.e., every five years) to provide reasonable assurance that the load allocation for wastewater is attained.

2.3 Approach

Treated wastewater flow data for the period January 1999 through June 2002 and mercury concentration data for the period January 2000 through June 2002 were obtained from the Regional Board electronic reporting database for individual treatment facilities. Those data were used to calculate an updated estimate of annual mercury loads from municipal and industrial treatment facilities. The important assumptions used in making the calculations are as follows:

Monthly mercury measurements were averaged to form a single average mercury concentration for each facility. For those facilities that did not have data, values of 15.3 ng/l, 5.4 ng/l, and 25 ng/l were used for secondary, advanced (tertiary), and industrial treatment plants, respectively. The default value of 15.3 ng/l is derived from the median value of the mercury concentrations in the available January 2000 to June 2002 data set for secondary treatment facilities. The default value of 5.4 ng/l is the mercury concentration for tertiary treatment facilities based on an assumed removal of 65% of the mercury in secondary effluent.

The total monthly flow volumes were summed and divided by the number of days that the flow was monitored to obtain an average daily flow rate. This value was then used to estimate the total annual flow discharged to the Bay from each facility. For treatment facilities that did not have data, the flows from the 2001 Regional Board staff report were used. It is assumed that the flow data reported to the Regional Board reflect the volume of treated wastewater discharged to the Bay.

Most of the data gaps that occurred were for smaller treatment facilities, which have minor impacts on the total mercury load to the Bay. An exception is the C&H Sugar/Crockett-Valona treatment facility, for which reliable flow and mercury concentration data were unavailable.

2.4 Results

Using the calculation methods described above, the updated average annual estimates of existing mercury loadings to the Bay from municipal and industrial wastewater treatment facilities are as follows:

Existing annual mercury loading from municipal facilities:	12.7 kg/yr
Existing annual mercury loading from industrial facilities:	2.1 kg/yr
Total existing annual mercury loading from wastewater treatment facilities:	14.8 kg/yr (+/- 3.3)

Spreadsheets showing the data used in the derivation of these estimates are summarized in Table 1 and Table 2.

2.5 References

Abu-Saba, K.E., and L.W. Tang, 2000. *Watershed Management of Mercury in San Francisco Bay: a TMDL report to USEPA*. SFRWQCB staff report presented to the Regional Board in a public hearing, June 20, 2000. Available from the SFRWQCB, Oakland, CA. www.swrcb.ca.gov/rwqbc2.

Katen, K. 2001. *Statistical Analysis of Pooled Data from Regionwide Ultraclean Mercury Sampling for Municipal Dischargers*. SFRWQCB staff report presented in a public hearing June 11, available at www.swrcb.ca.gov/rwqcb2.

Lam, Johnson, SFRWQCB, personal communication, August 2002. NPDES electronic data summaries.

Looker, R.E., and Johnson, B.J. 2003. *Mercury in San Francisco Bay: TMDL project report*. SFRWQCB Draft staff report presented to stakeholders in a public workshop on July 2, 2003. Available at www.swrcb.ca.gov/rwqbc2

SFRWQCB, 1999. August 4, 1999 letter from Lawrence Kolb, acting Executive Officer, to all NPDES permit holders with self-monitoring requirements. Letter invokes Regional Boards authority to require monitoring information as set forth in Section 13267 of the California Water Code.

Taylor, K.A. *Defining the mercury problem in the northern reaches of San Francisco Bay and designing appropriate regulatory approaches*. SFRWQCB draft staff report presented to the SFRWQCB in a public hearing December, 1998.

Facility	Treatment	Annual Effluent flow (L x 10 ⁹)	Flow-weighted mean [Hg] (ng/L)	Annual mercury load (kg)
San Jose/Santa Clara WPCP – 23	Advanced	165 +/- 13	3 +/- 1	0.5 +/- 0.1
East Bay MUD – 9	Secondary	107 +/- 24	30 +/- 14	3.2 +/- 1.7
EBDA, East Bay Dischargers Authority – 8	Secondary	106 +/- 10	19 +/- 9	2.0 +/- 0.9
City & Co. of S.F., Southeast – 21	Secondary	109 +/- 26	13 +/- 14	1.4 +/- 1.6
Central Contra Costa S.D – 6	Secondary	62 +/- 8	28 +/- 8	1.7 +/- 0.6
City of Palo Alto – 19	Advanced	37 +/- 3	7 +/- 3	0.2 +/- 0.1
So. Bayside System Authority – 29	Advanced	27 +/- 4	16 +/- 8	0.4 +/- 0.2
West County Agency – 34	Secondary	23 +/- 2	15 +/- 6	0.3 +/- 0.1
City of Sunnyvale – 32	Advanced	22 +/- 13	4 +/- 2	0.1 +/- 0.1
Napa S.D. – 15	Advanced	17 +/- 2	5 +/- 3	0.1 +/- 0.0
Delta Diablo S.D. – 7	Secondary	18 +/- 2	12 +/- 2	0.2 +/- 0.0
City of San Mateo – 24	Advanced	19 +/- 3	13 +/- 12	0.3 +/- 0.2
Fairfield Suisun Sewer Dist. – 10	Advanced	23 +/- 4	7 +/- 6	0.2 +/- 0.1
Vallejo Sanitation & Flood Cont. – 33	Secondary	21 +/- 6	19 +/- 6	0.4 +/- 0.2
City of Livermore (LAVWMA – EBDA)	Secondary	9 +/- 1	8 +/- 8	0.1 +/- 0.1
Dublin-San Ramon (LAVWMA –EBDA)	Secondary	15 +/- 3	32 +/- 45	0.5 +/- 0.7
Central Marin Sanitation A.G. – 5	Secondary	15 +/- 6	6 +/- 3	0.1 +/- 0.1
So. S.F./ San Bruno WQCP – 30	Secondary	14 +/- 1	17 +/- 6	0.2 +/- 0.1
City of Petaluma – 20	Secondary	8 +/- 3	5 +/- 2	0.04 +/- 0.03
Novato S.D. – 17	Advanced	8 +/- 1	5 +/- 6	0.04 +/- 0.05
City of Burlingame – 2	Secondary	6 +/- 1	9 +/- 5	0.05 +/- 0.03
Sewerage Agency of So. Marin – 27	Secondary	5 +/- 2	21 +/- 6	0.10 +/- 0.05
Sonoma Valley County S.D. – 28	Secondary	5 +/- 2	5 +/- 1	0.02 +/- 0.01
City of Pinole-Hercules – 11	Secondary	4 +/- 1	6 +/- 4	0.02 +/- 0.01
City of Benicia – 1	Secondary	4 +/- 1	15 +/- 11	0.07 +/- 0.05
City of Millbrae – 2	Secondary	3 +/- 0	16 +/- 15	0.04 +/- 0.04
Las Gallinas Valley S.D. – 12	Secondary	5 +/- 2	52 +/- 20	0.26 +/- 0.13
Mt. View S.D. – 14	Secondary	3 +/- 1	9 +/- 6	0.03 +/- 0.02
Sausalito-Marin City S.D. – 25	Advanced	2 +/- 1	23 +/- 9	0.05 +/- 0.02
City & Co. of S.F., Int. Airport - 2	Secondary	1 +/- 1	24 +/- 20	0.03 +/- 0.03
Marin Co. S.D. #5/Tiburon – 13	Secondary	1 +/- 0	6 +/- 5	0.01 +/- 0.01
Rodeo S.D. – 11	Secondary	1 +/- 0	16 +/- 27	0.02 +/- 0.03
City of Calistoga – 3	Advanced	1 +/- 0	5 +/- 6	0.01 +/- 0.01
Town of Yountville – 35	Advanced	0 +/- 0	5 +/- 6	0.00 +/- 0.00
City of St. Helena – 31	Secondary	0 +/- 0	15 +/- 6	0.01 +/- 0.00
Total				12.7 +/- 2.7

Table 1: Summary of current flows, concentrations and loads for municipal pollution control plants. Numbers next to each facility name refer to map locations in Basin Plan (Figure 1).

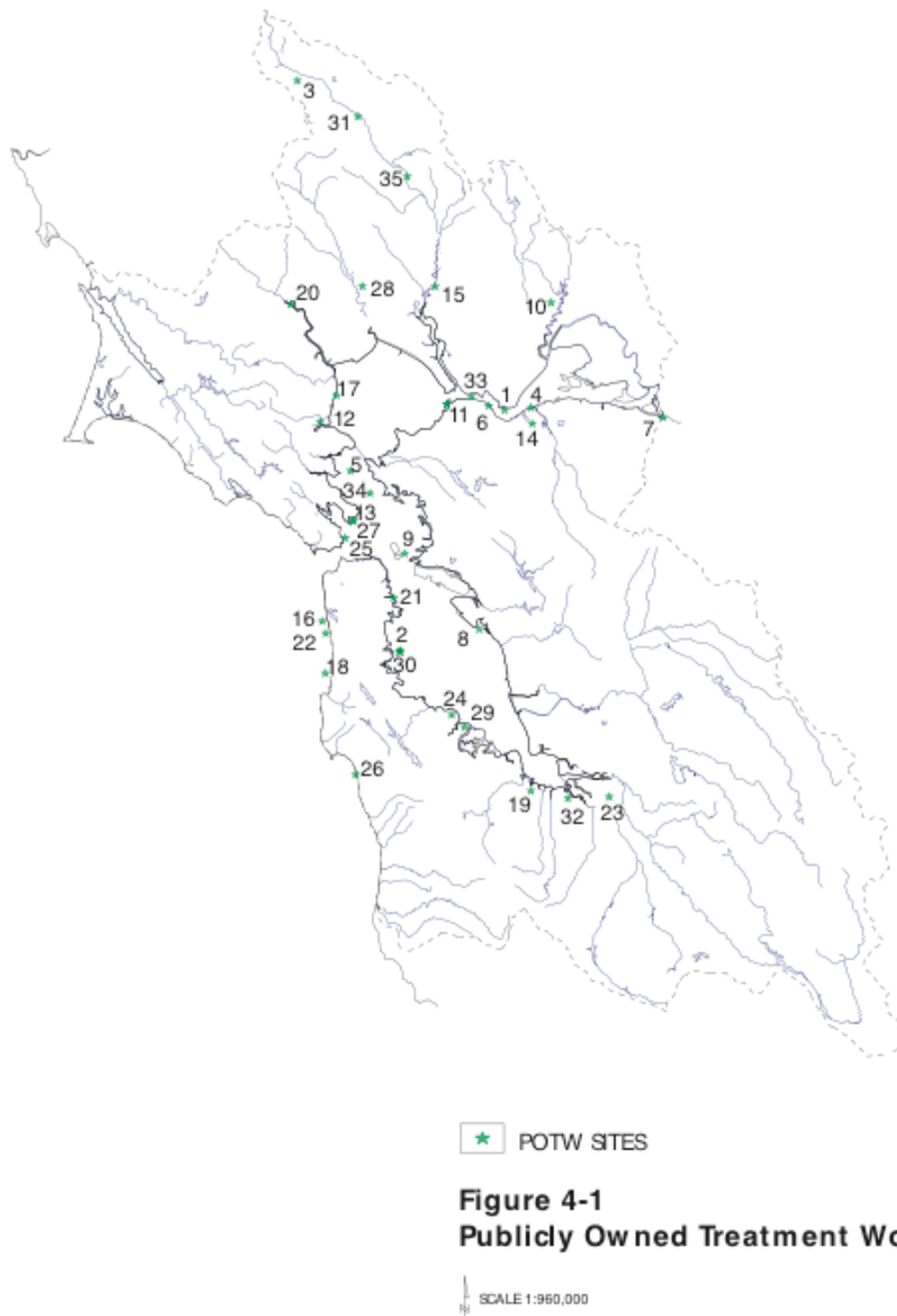


Figure 1: Locations of publicly owned treatment works. Figure taken from San Francisco Bay Basin Plan.

Facility	Treatment	Total Annual Effluent flow (L x 10 ⁹)	Flow-weighted average mercury concentration (ng/L)	Annual mercury load (kg)
C&H Sugar Co. – 2	Activated sludge	34 +/- 3	25 +/- 10	0.8 +/- 0.3
Chevron U.S.A. – 3	Activated sludge/wetland	9 +/- 4	66 +/- 43	0.6 +/- 0.5
Equilon Enterprises LLC. – 8	Activated sludge/carbon	8 +/- 1	11 +/- 17	0.1 +/- 0.1
Tosco Corp. Avon Refinery -12 (Tesoro Golden Eagle Refinery)		6 +/- 3	7 +/- 4	0.04 +/- 0.03
Dow Chemical Co. – 4	Neutralization/activated carbon	0 +/- 0	30 +/- 69	0.01 +/- 0.02
Exxon	Activated sludge/carbon	3 +/- 0	13 +/- 8	0.03 +/- 0.02
Tosco Corp. Rodeo Refinery –11	Pond/RBC/carbon	3 +/- 1	30 +/- 34	0.09 +/- 0.10
San Francisco Int. Airport	Physical/chemical	1 +/- 0	18 +/- 15	0.02 +/- 0.02
General Chemical Corp. Bay Point Works – 1	Neutralization/pond	1 +/- 1	335 +/- 279	0.2 +/- 0.3
Rhone Poulenc Basic Chemical Co. – 9	Neutralization/pond	0 +/- 0	48 +/- 90	0.01 +/- 0.01
Zeneca Agricultural Products – 10	Activated carbon/pond	0 +/- 0	25 +/- 10	0.0 +/- 0.0
USS Posco – 13	Physical/chemical	11 +/- 3	3 +/- 3	0.04 +/- 0.04
U.S. Navy Treasure Island		1 +/- 3	23 +/- 11	0.02 +/- 0.06
		Total		2.1 +/- 0.7

Table 2: Summary of current flows, concentrations, and loads for industrial pollution control plants. Numbers next to facility ID refers to map location in Basin Plan (Figure 2). Loads in this table sum to 2.0 kg/ye, but written in as 2.1 kg/yr to be consistent with TMDL Project Report (Looker and Johnson, 2003).

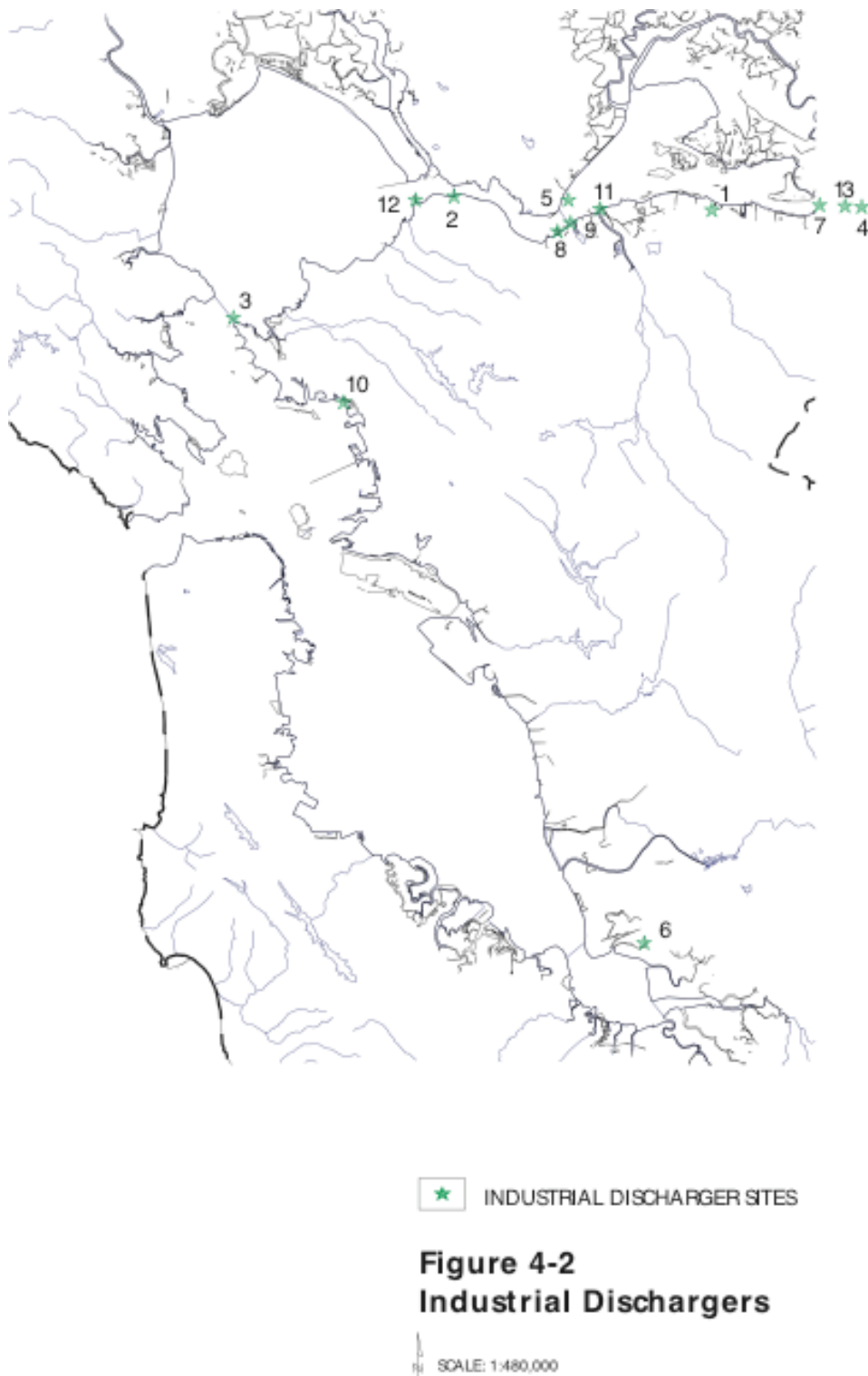


Figure 2: Locations of Industrial Dischargers to San Francisco Bay. Map taken from San Francisco Bay Basin Plan.

3. Effect of growth and development on average annual mercury loads from municipal and industrial wastewater treatment facilities

3.1 Purpose

Estimate future treated wastewater flows and associated mercury loadings at Bay area treatment facilities.

3.2 Background

The existing population of the San Francisco Bay area is approximately 6 million. Projected population growth will occur in communities with available undeveloped land and strong economic foundations. "Smart Growth" plans may also encourage increases in population densities near job and transit centers. Consequently, the magnitude and rate of growth at each Bay area treatment facility will be variable.

Regional population growth estimates are available through the Association of Bay Area Governments (ABAG). These estimates indicate expected population growth in Bay area cities and counties through the year 2025.

3.3 Approach

The population estimates for individual cities were apportioned to the corresponding individual treatment facilities based on service area information taken from individual NPDES permits. Percentage increases in population to the year 2025 were calculated for each facility. An overall projected growth rate was determined for each treatment facility (Table 3).

The assumed growth rates (expressed as a percentage) were used to estimate future (2025) flow increases at each facility. Projected increases in mercury load were calculated, using the existing mercury concentration and the estimated future flow. A spreadsheet showing these calculations is attached.

3.4 Results

The existing municipal and industrial treated wastewater flow and mercury loadings to the bay are estimated to be 692 mgd and 14.8 kilograms per year, respectively. Projected future (year 2025) baseline flow and baseline mercury loadings are estimated to be 800 mgd and 16.9 kilograms per year, respectively. Year 2025 flow and load estimates at individual treatment facilities are shown in Table 4. These estimates are used as a baseline for comparison with load reduction alternatives in the next section.

3.5 References

Association of Bay Area Governments (ABAG). *Projections 2002: Forecasts for the San Francisco Bay Area to the Year 2025*. Oakland: J.T. Litho (Printer) Dec. 2001. 286 pages.

SFRWQCB, 1998 – Present. Adopted NPDES permits for the treatment facilities considered in this analysis.

Table 3:

Projected population growth, by facility service area. Growth projections are estimates for purposes of projecting future wastewater discharge scenarios in this report. The growth estimates do not imply that local governments have adopted them in their master plans.

	2000 Census Population	2025 Est. Population	Growth between 2000 and 2025
City of Benicia (Benicia Wastewater Treatment Plant) –1			
BENICIA	26865	30,000	12%
Total	26865	30,000	11.7%
City of Burlingame (Burlingame Wastewater Treatment Plant) – 2			
BURLINGAME	28158	32,400	15%
OTHER	9000	11,400	27%
Total	37158	43,800	17.9%
City of Calistoga (Dunaweal Wastewater Treatment Plant) –3			
CALISTOGA	5190	6,800	31%
Total	5190	6,800	31.0%
Central Contra Costa SD (Central Contra Costa Wastewater Treatment Plant) –4			
CONCORD	121780	138,500	14%
DANVILLE	41715	45,500	9%
LAFAYETTE	23908	27,100	13%
MORAGA	16290	18,100	11%
ORINDA	17599	19,600	11%
PLEASANT HILL	32837	37,500	14%
WALNUT CREEK	64296	71,800	12%
CLAYTON	10762	13,500	25%
MARTINEZ	11900	13,500	13%
OTHER	80000	107,000	34%
Total	421087	492,100	16.9%
Central Marin Sanitation Agency (San Rafael SD, Sanitary District 1-2, Larkspur) –5			
SAN RAFAEL	56063	65,500	17%
ROSS	2329	2,480	6%
LARKSPUR	12014	13,300	11%
CORTE MADERA	9100	9,900	9%
Total	79506	91,180	14.7%

	2000 Census Population	2025 Est. Population	Growth between 2000 and 2025
Delta Diablo Sanitary District –7			
ANTIOCH	90532	117,500	30%
PITTSBURG	56769	85,100	50%
Total	147301	202,600	37.5%
East Bay Dischargers Authority –8			
HAYWARD	140030	160,300	14%
SAN LEANDRO	79452	87,600	10%
UNION CITY	66869	84,700	27%
NEWARK	42471	53,400	26%
FREMONT	203413	233,200	15%
Total	532235	619,200	16.3%
EBMUD –9			
ALAMEDA	72259	80,600	12%
ALBANY	16444	18,000	9%
BERKELEY	102743	111,600	9%
EMERYVILLE	6882	11,200	63%
OAKLAND	399484	449,500	13%
PIEDMONT	10952	11,300	3%
EL CERRITO	23171	24,700	7%
OTHER	6000	7,400	23%
Total	637935	706,900	10.8%
Fairfield Suisun - 10			
FAIRFIELD	96178	135,700	41%
SUISUN CITY	26118	35,300	35%
Total	122296	171,000	39.8%
Las Gallinas – 11			
OTHER	28000	30700	9.6%
Total	28000	30700	9.6%

	2000 Census Population	2025 Est. Population	Growth between 2000 and 2025
Livermore-Amador Valley Water Management Agency –8			
LIVERMORE	73345	99,400	36%
PLEASANTON	63654	83,600	31%
DUBLIN	29973	63,100	111%
SAN RAMON*	44722	82,500	84%
Total	211694	328,600	55.2%
Millbrae (Water Pollution Control Plant) – 2			
MILLBRAE	20718	23,100	11%
Total	20718	23,100	11.5%
Mt. View Sanitary District – 14			
MARTINEZ	24000	27,200	13%
Total	24000	27,200	13.3%
Napa (Soscol Water Recycling Facility) – 15			
AMERICAN CANYON	9774	14,200	45%
NAPA	72585	98,100	35%
Total	82359	112,300	36.4%
Novato (Novato and Ignacio Plants) – 17			
NOVATO	47630	59,900	26%
Total	47630	59,900	25.8%
Palo Alto (Palo Alto Regional Water Quality Control Plant) - 19			
PALO ALTO	58598	67,500	15%
MOUNTAIN VIEW	70708	80,700	14%
LOS ALTOS	27693	29,700	7%
LOS ALTOS HILLS	7902	8,900	13%
MENLO PARK	30785	33,900	10%
EAST PALO ALTO	29506	38,200	29%
Total	225192	258,900	15.0%

	2000 Census Population 2000 Census	2025 Est. Population 2025 Est.	Growth between 2000 and 2025 Growth between
Petaluma – 20			
PETALUMA	54548	64,200	18%
Total	54548	64,200	17.7%
Pinole Hercules (Pinole-Hercules Water Pollution Control Plant) – 11			
PINOLE	19039	21,400	12%
HERCULES	19488	26,100	34%
Total	38527	47,500	23.3%
Rodeo – 11			
OTHER	8500	11,400	34.1%
Total	8500	11,400	34.1%
St. Helena 31			
ST. HELENA	5950	7,900	33%
Total	5950	7,900	32.8%
SF – SE – 21			
BRISBANE	3597	5,480	52%
SAN FRANCISCO	776733	815,200	5%
Total	780330	820,680	5.2%
SF-Bayside			
Total			
SFO (San Francisco International Airport Water Quality Control Plant) – 2			
Total			
SD No. 5 Marin – 13			
BELVEDERE	2125	2,260	6%
TIBURON	8666	9,200	6%
Total	10791	11,460	6.2%

	2000 Census Population	2025 Est. Population	Growth between 2000 and 2025
San Jose (San Jose/Santa Clara Water Pollution Control Plant) - 23			
CAMPBELL	38138	41,700	9%
CUPERTINO	50546	64,500	28%
LOS GATOS	28592	32,500	14%
MILPITAS	62698	86,200	37%
MONTE SERENO	3483	4,400	26%
SAN JOSE	894943	1,096,200	22%
SANTA CLARA	102361	134,000	31%
SARATOGA	29843	33,600	13%
Total	1210604	1,493,100	23.3%
San Mateo (City of San Mateo Water Quality Control Plant) – 24			
SAN MATEO	92482	108,300	17%
FOSTER CITY	28803	33,000	15%
HILLSBOROUGH	10825	11,800	9%
Total	132110	153,100	15.9%
Sausalito Marin 25			
SAUSALITO	7330	7,900	8%
OTHER	11000	12,100	10%
Total	18330	20,000	9.1%
SASM – 27			
MILL VALLEY	13600	14,500	7%
OTHER	12000	13,100	9%
Total	25600	27,600	7.8%
Sonoma Co - 28			
SONOMA	9128	11,900	30%
OTHER	28000	36,900	32%
Total	37128	48,800	31.4%

DRAFT Mercury Implementation for Wastewater Treatment Plants CEP Project 4.5
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	2000 Census Population	2025 Est. Population	Growth between 2000 and 2025
SBSA – 29			
REDWOOD CITY	75402	85,300	13%
BELMONT	25123	28,000	11%
SAN CARLOS	27718	29,700	7%
ATHERTON	7194	8,000	11%
PORTOLA VALLEY	4462	5,300	19%
WOODSIDE	5352	6,000	12%
OTHER	50000	63,400	27%
Total	195251	225,700	15.6%
 So SF San Bruno – 30			
SAN BRUNO	40165	44,700	11%
SOUTH SAN FRANCISCO	60552	68,500	13%
Total	100717	113,200	12.4%
 Sunnyvale (Sunnyvale Water Pollution Control Plant – 32			
SUNNYVALE	131760	150,100	14%
Total	131760	150,100	13.9%
 Vallejo Sanitation and Flood Control - 33			
VALLEJO	116760	143,600	23%
Total	116760	143,600	23.0%
 West County Agency – 34			
SAN PABLO	30215	32,200	7%
RICHMOND	99216	112,200	13%
OTHER	20000	26,800	34%
Total	149431	171,200	14.6%
 Yountville - 35			
YOUNTVILLE	2916	3,400	17%
Total	2916	3,400	16.6%

DRAFT Mercury Implementation for Wastewater Treatment Plants CEP Project 4.5
7/28/03

Facility	Treatment	Total Annual Effluent flow (L x 10 ⁹)	Flow-weighted average mercury concentration (ng/L)	Annual mercury load (kg)
San Jose/Santa Clara WPCP	Advanced	204 +/- 16	3 +/- 1	0.6 +/- 0.2
East Bay MUD	Secondary	119 +/- 26	30 +/- 14	3.5 +/- 1.9
EBDA, East Bay Dischargers Authority	Secondary	123 +/- 11	19 +/- 9	2.3 +/- 1.1
City & Co. of S.F., Southeast	Secondary	115 +/- 27	13 +/- 14	1.5 +/- 1.6
Central Contra Costa S.D	Secondary	73 +/- 10	28 +/- 8	2.0 +/- 0.7
City of Palo Alto	Advanced	42 +/- 4	7 +/- 3	0.3 +/- 0.1
So. Bayside System Authority	Advanced	31 +/- 5	16 +/- 8	0.5 +/- 0.3
West County Agency	Secondary	26 +/- 3	15 +/- 6	0.4 +/- 0.2
City of Sunnyvale	Advanced	25 +/- 15	4 +/- 2	0.1 +/- 0.1
Napa S.D.	Advanced	22 +/- 3	5 +/- 3	0.1 +/- 0.1
Delta Diablo S.D.	Secondary	25 +/- 3	12 +/- 2	0.3 +/- 0.1
City of San Mateo	Advanced	22 +/- 4	13 +/- 12	0.3 +/- 0.3
Fairfield Suisun Sewer Dist.	Advanced	32 +/- 6	7 +/- 6	0.2 +/- 0.2
Vallejo Sanitation & Flood Cont.	Secondary	26 +/- 7	19 +/- 6	0.5 +/- 0.2
City of Livermore (LAVWMA – EBDA)	Secondary	13 +/- 1	8 +/- 8	0.1 +/- 0.1
Dublin - San Ramon (LAVWMA – EBDA)	Secondary	25 +/- 5	32 +/- 45	0.8 +/- 1.1
Central Marin Sanitation A.G.	Secondary	17 +/- 7	6 +/- 3	0.1 +/- 0.1
So. S.F./ San Bruno WQCP	Secondary	16 +/- 2	17 +/- 6	0.3 +/- 0.1
City of Petaluma	Secondary	10 +/- 4	5 +/- 2	0.0 +/- 0.0
Novato S.D.	Advanced	10 +/- 1	5 +/- 6	0.1 +/- 0.1
City of Burlingame	Secondary	7 +/- 1	9 +/- 5	0.06 +/- 0.03
Sewerage Agency of So. Marin	Secondary	5 +/- 2	21 +/- 6	0.10 +/- 0.05
Sonoma Valley County S.D.	Secondary	7 +/- 3	5 +/- 1	0.03 +/- 0.02
City of Pinole-Hercules	Secondary	5 +/- 1	6 +/- 4	0.03 +/- 0.02
City of Benicia	Secondary	5 +/- 1	15 +/- 11	0.07 +/- 0.05
City of Millbrae	Secondary	3 +/- 1	16 +/- 15	0.05 +/- 0.05
Las Gallinas Valley S.D.	Secondary	6 +/- 2	52 +/- 20	0.29 +/- 0.14
Mt. View S.D.	Secondary	3 +/- 1	9 +/- 6	0.03 +/- 0.02
Sausalito-Marin City S.D.	Advanced	2 +/- 1	23 +/- 9	0.06 +/- 0.03
City & Co. of S.F., Int. Airport	Secondary	1 +/- 1	24 +/- 20	0.03 +/- 0.03
Marin Co. S.D. #5/Tiburon	Secondary	1 +/- 0	6 +/- 5	0.01 +/- 0.01
Rodeo S.D.	Secondary	2 +/- 0	16 +/- 27	0.03 +/- 0.04
City of Calistoga	Advanced	1 +/- 0	5 +/- 6	0.01 +/- 0.01
Town of Yountville	Advanced	1 +/- 0	5 +/- 6	0.00 +/- 0.00
City of St. Helena	Secondary	1 +/- 0	15 +/- 6	0.01 +/- 0.00
Total				14.8 +/- 3.1

Table 4: Projected POTW mercury loads in 2025 if effluent concentrations remain unchanged.

4. Technological and programmatic options to manage mercury loads from municipal and industrial wastewater treatment facilities

4.1 Purpose

Quantify the costs and benefits of various mercury load management strategies that could be applied to wastewater treatment facilities in the Bay area.

4.2 Background

As part of the Basin Plan amendment process, the Regional Board considers the economic impact of proposed implementation plans and alternatives to satisfy its obligations under the California Water Code and CEQA. The following analysis has been prepared to provide assistance to Regional Board staff in understanding and quantifying the cost of infrastructural and programmatic approaches to managing mercury loads from wastewater treatment plants.

The range of options for mercury load reduction by wastewater treatment entities considered in this analysis is as follows:

Additional wastewater treatment - Treatment-based load reduction options include (1) filtration at existing secondary treatment plants and (2) reverse osmosis following filtration.

Additional water recycling – Recycling is currently practiced at a number of Bay area municipal facilities. The estimated annual recycled water volume is 20,000 acre-feet (BARWRP, 1999). The estimated avoided mercury load to the Bay due to the existing recycling effort is in the range from 0.1 to 0.4 kilograms per year (based on mercury concentrations ranging from 5.4 ng/l to 15.3 ng/l and an annual volume of 6520 million gallons (=20,000 acre-feet)). Potential future recycling uses include residential irrigation, irrigation of parks, golf courses and cemeteries, commercial and industrial uses, agricultural irrigation, stream flow augmentation, groundwater recharge and potable impoundment augmentation. A major planning study to evaluate future water demands and water recycling opportunities for the Bay area was completed by the San Francisco Bay Area Regional Water Recycling Program (BARWRP) in 1999 (San Francisco Bay Area Water Recycling Program, 1999). That study identified a two-stage program for future water recycling projects in the Bay area region.

Additional pollution prevention/source control - Municipal agencies have implemented pollution prevention and source control programs for mercury. Primary emphasis in those programs has been on dental offices, hospitals/medical clinics and household products. This analysis uses a previous study (AMSA, 2002) to estimate anticipated costs and load reduction benefits of implementing pollution prevention to the maximum extent practicable in the service areas of all Bay Area pollution control plants.

4.3 Approach

Cost estimates and load reduction estimates were identified for the above options, where possible. The methods used in deriving these estimates are described below.

Additional wastewater treatment: Unit costs for filtration, reverse osmosis, and filtration plus RO were derived from cost estimates contained in 1993 National Research Council publication titled *Managing Wastewater in Coastal Urban Areas* (NRC 1993). The following annual unit costs (expressed as \$ million per year per mgd) were derived from the information provided in the NRC publication and are used to estimate costs in this analysis:

Filtration	0.18 – 0.65
Filtration plus RO	1.20

These costs are derived from annualized capital and annual operation and maintenance costs and are indexed to a 2001 construction cost index of 6342. The source document for these costs included costs with an estimated 1991 construction cost index of 4835.

These costs were checked against unit costs derived from a recent wastewater master plan report (Carollo, 2001). Carollo estimated the reverse osmosis cost based on the use of microfiltration (MF) rather than dual media filtration ahead of the RO process. The Carollo MF/RO unit cost, adjusted to a cost index of 6342, was \$1.15 million per year per mgd, a close match to the unit cost (1.20) stated above. The Carollo unit cost for filtration was \$0.65 million per year per mgd, significantly higher than the unit cost (0.18) cited in NRC, 1993. The \$0.18 million per year per mgd is considered as the lower bound and \$0.65 million per year per mgd as the upper bound for filtration costs.

The estimated mercury load reductions resulting from the additional treatment options described above are based on assumed removal efficiencies. For filtration, the assumed mercury removal efficiency was calculated from the median effluent concentration values for secondary (13.6 ng/l) versus advanced treatment (4.8 ng/l) taken from the June 2001 Regional Board staff report. Mercury removal efficiencies for reverse osmosis were calculated assuming a final RO effluent concentration of 2 ng/l. Final effluent concentrations were calculated for each facility based on the following assumed treatment efficiencies:

Filtration	65 % removal of Hg from secondary effluent
Reverse Osmosis	60 % removal of Hg from filtered secondary effluent

Additional recycling: The estimated cost for future recycling projects are based on information regarding recycling volumes and recycling costs contained in the San Francisco Bay Area Regional Water Recycling Program (BARWRP) report dated 1999. Costs developed in that report included treatment, distribution and on-site costs at the place of use. Assumed treatment prior to recycling was to meet Title 22 recycled water

requirements (secondary treatment plus filtration and enhanced disinfection) for most uses. In the BARWRP report, where TDS levels in effluent exceed 900 mg/l and recycled use included irrigation of agricultural crops, it was assumed that RO would be required.

The two stages of regional recycling projects identified in the BARWRP report were (1) 125,000 acre-feet per year (consisting primarily of service with Title 22 recycled water to commercial users, industrial users, parks, golf courses and cemeteries) and (2) 240,000 acre-feet per year (serving an expanded list of users and requiring RO treatment for a portion of the volume). The stage 1 program would include recycling projects at 22 municipal treatment facilities discharging to the Bay. The stage 2 program would involve increased recycled water supply from 17 of those 22 facilities. The estimated annual costs for these two stages are \$79 million per year and \$239 million per year, respectively.

The estimated mercury load reduction associated with implementation of these recycled water projects is calculated for each treatment facility based on recycled volume estimates provided in the BARWRP report.

Additional source control: The estimated annual cost range for mercury source control programs at a typical municipal facility is \$250,000 to \$700,000 (AMSA, 2001). This reflects, the staff time to implement programs and the disposal costs of recovered mercury, and the cost of "take-backs." To derive a conservative, upper estimate of the cost of maximizing pollution prevention and source control programs, the AMSA estimate of \$250,000 - \$700,000 per facility was multiplied by the 34 POTWs, resulting in a total cost of \$8 million - \$25 million for pollution prevention and source control.

Over the past ten years in the SF Bay area, waste minimization, pollution prevention and source control programs have been implemented by wastewater agencies for a number of pollutants, including mercury. For mercury, pollution prevention and source control activities have focused on dental offices, hospitals and household products. However, the effectiveness of these efforts in reducing effluent concentrations (and loads) has not been well documented at most facilities. The same can be said at the national level. To address this question, the Association of Metropolitan Sanitation Agencies (AMSA) commissioned a national study of municipal treatment plants that have collected influent and effluent mercury data of sufficient quality and quantity to enable evaluation. In particular, each of the facilities included in the AMSA study has implemented USEPA Method 1631 to achieve suitable low detection limit mercury analysis on effluent.

The AMSA report employed two methods to estimate effluent concentrations as a result of source control. The first method assumed that effluent concentrations would decrease by the same percentage as predicted for influent. That is, by the first method, if source control reduced influent concentrations by 25 percent, it was assumed that effluent concentrations would decrease by 25 percent. This represents the absolute upper bound on the benefit of mercury source control. The second method (a

probability-based approach) used actual data relationships between influent and effluent in predicting effluent concentrations.

Results from the both methods are used to establish a range. If effluent concentrations are directly proportional to influent concentrations, then the expected effluent load reduction due to increased source control and pollution prevention would be 26% – 33 %. On the other hand, based on actual measured plant performance, the AMSA report projects that reductions in effluent load reductions of mercury after implementation of pollution prevention and source control is 2% to 3%. Since this is based on actual data, the best guess is that actual reductions in effluent concentrations will be closer to 2%, rather than 33%.

Additional benefits of pollution prevention and source control include projected influent load reductions of 26% to 33%. This results in a decreased quantity of mercury in the biosolids for the facility, which will result in a decrease in loadings to landfills and may result in a decreased loading to the atmosphere (where incinerators are employed for biosolids volume reduction, depending part on the efficiency of capture of mercury in the air pollution control equipment on the incinerator). The risk reduction benefit of decreased mercury loadings to biosolids, incinerators, and landfills has not been quantified.

For both projected costs and projected load reductions, it should be recognized that pollution prevention and source control have already been substantially implemented throughout the Bay Area. Therefore, new costs may be substantially less than \$8 – 25 million. If so, then the benefit of expected additional load reductions would also be commensurately lower, because the load reductions would have already been realized.

4.4 Results

Addition of filtration to Bay area municipal facilities which do not currently have filtration is estimated to cost an additional \$80 – 300 million per year to address projected 2025 flows (723 mgd). The addition of filtration would drop the projected annual mercury loading from 14.8 to 6.3 kilograms per year for municipal effluent. For industrial facilities, filtration would cost an additional \$14 – 60 million per year and would reduce the industrial loading from 2.0 to 0.7 kilograms per year. The projected total annual mercury loading from wastewater treatment facilities with filters in place would be 7.0 kilograms per year at an additional annual cost of \$94 - 380 million.

Addition of filtration and reverse osmosis to Bay area municipal facilities would cost an additional \$817 million per year to address projected 2025 flows. The estimated municipal mercury loading following the addition of filtration and RO would be 2.5 kilograms per year. The annual mercury loading from industrial wastewater treated through filters and RO is estimated to be 0.3 kilograms per year, at a cost of \$92 million per year. The projected total annual mercury loading from wastewater after addition of

filters and RO on a Bay-wide basis would be 2.8 kilograms per year. The estimated cost of this treatment would be \$909 million per year.

Implementation of major additional water recycling facilities in the Bay area is estimated to cost between \$79 and \$239 million per year. The reduction in 2025 mercury loading resulting from such recycling efforts would range from 2.2 to 3.6 kilograms per year, depending on the magnitude of the recycling project. Resulting future mercury loadings to the Bay would be approximately 8 to 14 kilograms per year after implementation of the recycling programs. The range reflects the different degrees of recycling (Stage 1 vs. Stage 2) and the uncertainty of the response to pollution prevention programs.

The estimated annual cost for additional mercury pollution prevention and source control activity in the Bay area is in the range from \$8 to \$25 million. Based on an expected reduction of 2% - 33% in effluent concentrations, the future mercury load in 2025 would be 11.3 – 16.6 kg/yr from all wastewater treatment facilities.

The cost and mercury load reduction estimates for treatment of storm water in wastewater treatment facilities require site-specific study, as described in Section 5. A summary matrix of load reduction costs and benefits for the above options is provided in Table 5.

4.5 References

Association of Metropolitan Sewerage Agencies. 2002. *Mercury Source Control and Pollution Prevention Program Evaluation*. Prepared by Larry Walker Associates for AMSA under USEPA Grant Assistance ID No. CX827577-01-0. March.

National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas*. National Academy Press. Washington, D.C.

San Francisco Bay Regional Water Quality Control Board: adopted NPDES permits for the treatment facilities considered in this analysis (1998 – present).

San Francisco Bay Area Regional Water Recycling Program. 1999. *Recycled Water Master Plan*. December. Available from RMC Engineering, Walnut Creek, CA, www.rmcegr.com.

Carollo Engineers. 2001. *Sacramento Regional Wastewater Treatment Plant – 2020 Master Plan. Final Draft Summary Report*. Prepared for Sacramento Regional County Sanitation District. November.

Scenario	Total Mercury Load (kg/year)	Additional annualized capital and operating costs over current expenditures (\$ millions)	Additional Benefits, considerations
2002	15 +/- 3	0	Baseline
A: No Action – 2025	17 +/- 3	0	Resources not spent on mercury can be spent on other pollutants. Pollution prevention and source control already substantially implemented.
B: Pollution prevention (P2)	11 – 16.5	8 – 25	Potential benefits of additional P2: further reduction in influent mercury leads to reduction of mercury in sludge, helps move towards overall reduction of anthropogenic mercury use and release.
C1: Pollution Prevention + Reclamation Stage 1	9 – 14	87 - 104	P2 as Scenario B; reduction of other pollutant loads, increased water resources available for water supply, Delta outflow.
C2: Pollution Prevention + Reclamation Stage 2	8 – 12	247 - 264	P2 as Scenario B; reduction of other pollutant loads, increased water resources available for water supply, Delta outflow.
D: Pollution prevention + Reclamation Stage 1 +Tertiary (filtered) Baywide	<7	167 – 404	P2, Reclamation as Scenario C1, 50 to 65 percent reduction of other pollutants associated with particulate phase
E: Reverse Osmosis Baywide	<3	917 - 934	Over 700 mgd of high-quality water available. Significant energy use requirements, treatment and disposal of 140 mgd brine stream

Table 5: Cost benefit summary of mercury load management alternatives for POTWs

5. Feasibility of using excess treatment capacity to reduce urban runoff mercury loads at strategic locations

5.1 Purpose

Identify the key factors to be considered in assessing the feasibility of connecting urban runoff facilities to wastewater treatment facilities to reduce mercury (and other pollutant) loading to SF Bay.

5.2 Background

A concept has been identified to connect portions of urban storm drain systems to wastewater treatment plants as a method of reducing mercury loadings to SF Bay. This practice has been employed in Southern California as a method to reduce coliform contamination of beaches. In those examples, the approach has been to route dry weather urban runoff (which contains high coliform levels) to wastewater treatment plants that have available treatment capacity to accommodate those dry season flows. Typically those treatment plants discharge through ocean outfalls that provide dilution in the range from 100 to 200 to one. The NPDES permits for those treatment facilities are written to provide dilution credit for the actual dilution that occurs.

Mercury in urban runoff is primarily associated with suspended sediments. Therefore, highest mercury loads will occur where high mercury concentrations in sediments and high suspended sediment levels occur. Elevated mercury concentrations in sediments must be identified through monitoring at specific locations. Suspended sediment concentrations are typically significantly elevated during early season, first flush storm events. Therefore, as opposed to the treatment of dry season urban runoff flows to control coliform bacteria, treatment of first flush storm flows in areas where mercury sediment levels are high is likely to have the greatest benefit in terms mercury load reduction. Treatment of dry season urban runoff is not expected to reduce significant suspended sediment or mercury quantities.

The connection of urban runoff flows to wastewater treatment plants is an unconventional practice in most Bay Area communities. Wastewater collection and treatment systems have been designed to exclude urban runoff flows in those communities. Excess treatment capacity in existing facilities has been constructed to accommodate future wastewater flows, without consideration of storm-related contributions, aside from allowances for infiltration and inflow to the wastewater collection system. An exception exists in the City of San Francisco, where special conveyance, storage and treatment facilities have been constructed to handle both urban runoff and wastewater flows in a combined sewer system.

Due to the fundamental change in utility design associated with the connection of urban runoff flows to wastewater treatment facilities, a number of complex, site specific factors must be considered prior to implementing this concept, as described below.

5.3 Approach

The factors to be considered in a feasibility analysis for this concept should include the following:

The concept of “available excess treatment capacity” in existing wastewater treatment facilities needs to be defined and quantified from the perspective of treating first flush storm flows. Treatment capacity analyses involve the assessment of hydraulic (flow) capacity, as well as treatment (solids removal, solids handling disinfection) capacity. Excess capacity which exists today will ultimately be utilized, i.e. it is a commodity which declines over time, depending on the growth rate in the community. The time required to plan, design and construct the next increment of capacity will influence determination of “available excess capacity” at a given facility.

A table of existing average dry weather flows versus design flows should be developed as a preliminary screening effort to identify candidate Bay area treatment facilities for storm water treatment. Areas with elevated mercury concentrations in suspended storm water sediment should be identified using mercury monitoring data from urban runoff programs or other available sources. The mercury monitoring data should be summarized for each identified area. Monitoring data for other pollutants of concern (e.g. PCBs) should also be summarized.

An analysis of “available excess capacity” should be performed at those treatment facilities which (a) are identified in the initial screening effort as potentially having excess capacity and (b) are located in proximity to an area with elevated mercury concentrations in storm water. The analysis should quantify, for planning purposes, the “available excess capacity” at the selected treatment facilities and the “shelf life” for that capacity. Individual projects should be evaluated at a planning level for each of the identified treatment facilities. Project level analysis include connection facilities between the storm system and the treatment system (storage, pumps, conveyance piping and controls) which is largely a function of distance, operating costs to treat storm flows through the wastewater facility (power, chemicals), and costs to replace the capacity used for storm water treatment. Project level analysis should also include a compliance analysis with the existing NPDES permit for the facility to evaluate the ability to achieve 85 percent removal of BOD and suspended solids, effluent limits for conventional and toxic pollutants, and bypass prohibitions.

The potential benefits of each project should be estimated in terms of mercury (and other pollutant) load reductions. The calculation method for the annual load reduction requires the following information:

- The volume of storm water treated on an annual basis.
- The percent removal of suspended solids through the treatment process (85 percent through secondary, 95 percent removal through filtered secondary)
- The average suspended solids concentration in the storm flow to be treated

- The average mercury (and other pollutant) concentration on suspended sediment in the storm flow.

A funding mechanism and funding arrangements between the wastewater and storm water agencies must be developed and adopted. Agreements must be reached regarding the payment for the front-end costs to perform studies and engineering analysis required for the feasibility assessment.

Finally, while blending urban stormwater with municipal sewage has the potential to reduce multiple pollutant loads (e.g., PCBs and chlorinated pesticides), this could also have the unintended consequence of increasing the pollutant concentrations of biosolids. This is potentially a concern for proper biosolids management (Committee on Toxicants and Pathogens in Biosolids Applied to Land, 2002).

5.4 Results

The concept only has application on a site-specific basis, where a treatment facility with excess capacity is located near an area with elevated mercury in sediments. The typical project emerging from the original concept would be facilities to connect a storm system to a wastewater treatment facility to treat first flush storm flows. The project would typically include storage, pumps, pipelines and control systems. An alternative would be for the storm water agency to build separate wet weather treatment facilities (e.g. screening, sedimentation, disinfection) to handle storm flows from areas with high mercury concentrations.

Individual projects may have multi-pollutant benefits in special cases where sediments in runoff are elevated for multiple pollutants. Where multi-pollutant benefits would not occur, it is doubtful that the achievable reduction in mercury loading will offset the cost for facilities to implement the concept.

As an example, the hypothetical scenario of an industrialized catchment can be considered. Sediments collected from a catch basin at the Ettie Street puming station in West Oakland have approximately 1 ppm mercury and 3 ppm PCBs (Gunther et al., 2002). The catchment is estimated to produce between 0.04 and 0.1 million kilograms of sediment per year. Therefore, effectively capturing this sediment could potentially reduce mercury loads to the Bay by 0.04 – 0.1 kg per year, and PCB loads by 0.1 to 0.3 kg per year. If the stormwater carrying this sediment has an average TSS of 10 mg/L, this would mean that approximately 10^{10} liters of water would have to be treated – approximately 2200 million gallons. 2200 million gallons is a significant volume of water to treat – the nearest facility (EBMUD) has a dry-weather capacity of 75 million gallons per day, and less than that during wet weather. Treatment of 2200 million gallons over a month would use 60 million gallons per day of that capacity. Treatment of an extra 2200 million gallons over a period of a year would use an extra 6 million gallons per day of capacity, so the feasibility of treating stormwater would be enhanced by construction of storage facilities. A detailed feasibility assessment for this example should examine the cost of designing and constructing sufficient storage capacity (i.e., up to 2,000,000

gallons), pumps and pipes to transport the water approximately three miles, the cost of permitting and public review, and any changes to the biosolids management plan that might result.

Four general trends in the feasibility of improving water quality by capturing urban stormwater emerge from this example:

- 1) Feasibility of treating urban stormwater increases with increasing pollutant concentrations in sediments;
- 2) Feasibility also increases with increasing TSS levels in stormwater;
- 3) Feasibility decreases with increasing distance to the nearest facility; and
- 4) Feasibility increases with increasing wet-weather capacity.
- 5) Discreet, targeted water quality improvement systems may be more feasible than blending urban runoff with sewage.

5.5 References

Committee on Toxicants and Pathogens in Biosolids Applied to Land, 2002. Biosolids Applied to Land: Advancing Standards and Practices, National Research Council, Washington, D.C.

Gunther, A.J., Salop, P., Abu-Saba, K.E. and Feng, A., 2002. Characterization of PCB, Mercury, PAH, and Chlorinated Pesticide Concentrations in Drainages of Western Alameda County, CA, Livermore, CA.

Orange County Sanitation District, 2003. "Answer to questions about Urban Runoff Diversions." Fact Sheet available at www.ocsd.com.

Personal Communication. 2002. Charles Weir. East Bay Dischargers Authority. August.

Personal Communication. 2002. Khalil Abu-Saba. Applied Marine Sciences. August. Technical memorandum #2, CEP Project # HG-IP-1; 8/28/02.

6. Feasibility of managing mercury methylation in receiving waters

6.1 Purpose

Provide guidance for adaptive approaches to investigate linkages between design and operational choices of pollution control plants and mercury methylation in receiving waters.

6.2 Background

The conversion of mercury to methylmercury (“methylation”) is a key linkage between mercury loads and impairment of beneficial uses. Given that, and the fact that mercury loads from pollution control plants are less than 2% of total loads to the Bay, it is likely that management strategies to reduce methylation rates in the Bay may be more important than management strategies to reduce or control mercury loads from wastewater.

Mercury methylation in receiving waters happens when bacteria, especially sulfate reducing bacteria, assimilate inorganic mercury. Sulfate reducing bacteria thrive under low oxygen conditions, because they use sulfate as a terminal electron acceptor in their respiration of organic matter. Therefore, some typical environmental factors that affect mercury methylation are:

- 1) How readily inorganic mercury is assimilated by bacteria (the “bioavailability”);
- 2) The amount of sulfate available; and
- 3) Dissolved oxygen concentrations.

Pilot projects to evaluate the feasibility of managing mercury methylation should focus on how choices about the operation of wastewater treatment facilities affect these and other factors controlling mercury methylation.

For example, a methylmercury receiving water monitoring study conducted as a provision of the Fairfield-Suisun Sewer District (FSSD) NPDES permit (SFRWQCB, 1998) is an example of one such pilot study. The results from that study showed a linkage between low dissolved oxygen (DO) and enhanced methylation efficiency (Figure 3). Given the ability of sulfate reducing bacteria to thrive under low oxygen conditions, this finding was not surprising. An additional finding was that the linkage was present in both effluent receiving water and reference sloughs, suggesting that in this case, there was no detectable difference in the “bioavailability” of mercury in wastewater compared to ambient mercury.

Depressed DO in the vicinity of FSSD occurs because of decreased flow and the seasonal die-off of vegetation in the surrounding marshes. Discharge from FSSD actually enhances DO in the receiving water+. Thus, planning decisions made for other

reasons have also created a potential benefit for mercury management by reducing mercury methylation rates.

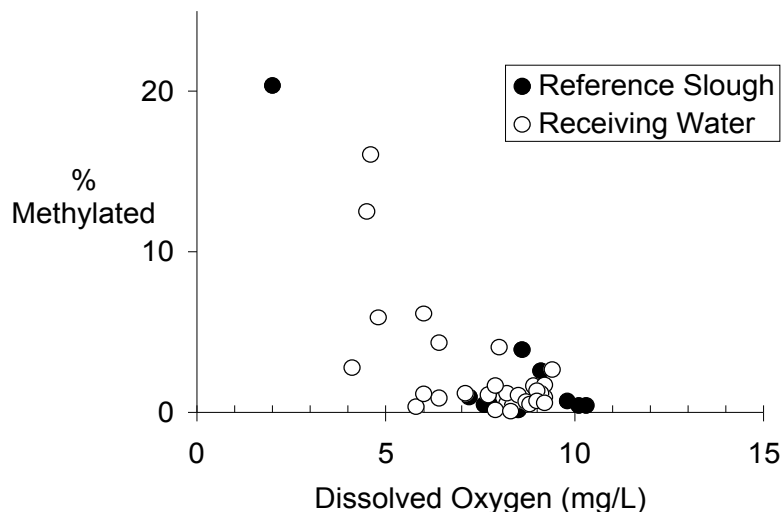


Figure 3: Fraction of mercury as methylmercury in the surface water of sloughs along the northern reach of San Francisco Bay plotted vs. dissolved oxygen. Note the general trend of increasing mercury methylation with decreasing dissolved oxygen. Data from NPDES receiving water study conducted by Fairfield Suisun Sewer district, courtesy Larry Bahr (Senior Environmental Scientist). Methylmercury measurements made by Dr. R.P. Mason, University of Maryland Chesapeake Biological Laboratories

6.3 Results

Several key questions need to be answered to determine the feasibility of affecting mercury methylation rates in Bay waters through operational decisions at POTWs. A key uncertainty is whether the bioavailability of mercury in POTW effluent is significantly greater or less than mercury in other sources. Knowing the answer to this would help resolve the importance and possible benefits, in terms of reduced mercury risk, to controlling mercury loads under the different scenarios presented in Table 5. As mentioned above, a preliminary study does not show a difference in the methylation efficiency of mercury in effluent receiving waters compared to a reference slough (Figure 3), but this could be explored in more detail and with a more regional scope.

Another question is whether dissolved oxygen management is an effective tool for reducing methylmercury concentrations in water. If so nitrification facilities that reduce ammonia levels in effluent may reduce mercury methylation in specific shallow water discharge situations by increasing DO levels. Assuming a unit cost of \$ 0.2 million / yr /

mgd (NRC, 1993), the cost to provide nitrification facilities serving 44 mgd would be approximately \$7.5 million / yr, and could provide ancillary habitat benefits of elevated DO and reduced ammonia. The validity of this hypothesis and the relative benefit to reducing methylmercury in fish must be ascertained before nitrification is mandated for such purpose.

Noting from the example above that discharge from FSSD helps maintain near-field DO, it is also possible that reclaimed water could be used to maintain flushing of shallow sloughs, thereby maintaining adequate DO levels and reducing mercury methylation rates. This emphasizes the importance of a regionally coordinated approach that combines treatment, reclamation, and receiving water monitoring to provide multiple environmental and resource conservation benefits.

Many treatment plants use alum (potassium aluminum sulfate) as a flocculant. Sulfate is an important factor affecting mercury methylation rates (Henry et al, 1992). In other ecosystems, it has been shown that there is an optimum sulfate concentration for enhanced mercury methylation, corresponding to sulfate concentrations typical of brackish waters. Thus, in effluent dominated freshwater marshes, it is possible that an alternative to alum as a flocculant might be desirable.

Answering these and similar questions involves several steps:

- 1) Development of a conceptual model;
- 2) Framing questions to test the conceptual model;
- 3) Conducting monitoring studies to answer the questions;
- 4) Revising the conceptual model according to the results of the monitoring studies;
- 5) Development and implementation of pilot projects based on the revised conceptual model to test adaptive management hypotheses;
- 6) Monitoring to verify the benefits of the pilot project;
- 7) Full-scale implementation of resulting actions of merit from the pilot projects.

The CEP has established a process for executing steps 1-4 above through development and implementation of its annual work plan. The draft year-two work plan includes resources for refinement of the mercury conceptual model and developing peer-reviewed study plans based on management questions. Resources to answer this kind of basic research question may exceed resources available to Bay Area local governments, so the CEP (or individual agencies that are part of the CEP) may need to seek outside funding to conduct monitoring and implement pilot projects if they desire to pursue management strategies that address mercury methylation.

6.4 References

San Francisco Bay Regional Water Quality Control Board, 1998. NPDES permit adopted for the Fairfield-Suisun Sewer District.

Gilmour, C.C., Henry, E.A., and Mitchel, R. 1992. Sulfate stimulation of mercury methylation in freshwater sediments. *Environmental Science and Technology* 26: 2281 – 2287.



B A S M A A

Alameda Countywide
Clean Water Program

Contra Costa
Clean Water Program

Fairfield-Suisun
Urban Runoff
Management Program

Marin County
Stormwater Pollution
Prevention Program

San Mateo Countywide
Stormwater Pollution
Prevention Program

Santa Clara Valley
Urban Runoff Pollution
Prevention Program

Vallejo
Sanitation and Flood
Control District

June 14, 2004

Mr. Bruce Wolfe

California Regional Water Quality Control Board - San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, CA 94612

**Re: Comments on the April 30, 2004 Mercury in San Francisco Bay Total
Maximum Daily Load (TMDL) Staff Report and Proposed Basin Plan
Amendment**

Dear Mr. Wolfe:

BASMAA member agencies appreciate this opportunity to comment on the Staff Report and Proposed Basin Plan Amendment (BPA) for the Mercury TMDL, and commend Water Board staff on the hard work put into preparing this document. We would also like to recognize the staff and participants of the San Francisco Estuary Regional Monitoring Program for Trace Substances (RMP) and Clean Estuary Partnership (CEP) for their contributions to this milestone.

BASMAA represents more than 90 Bay Area public agencies, including 79 cities and 7 counties (i.e., the bulk of the watershed immediately surrounding San Francisco Bay) on municipal stormwater-related (i.e., urban runoff) issues. BASMAA member agencies remain committed to addressing impairments to beneficial uses of San Francisco Bay Area water bodies impacted by urban stormwater runoff. We agree that reducing impairment of the Bay's beneficial uses by mercury should be a high priority to all Bay Area public agencies and citizens. Accordingly, municipal stormwater programs have redirected a portion of our limited public resources over the past few years toward investigating the extent of mercury in urban stormwater runoff and identifying sources and control measures. BASMAA member agencies also continue to allocate scarce resources toward regional collaborations such as the RMP and CEP, which are designed to help collect scientific information necessary to develop cost-effective measures to improve water quality in the San Francisco Estuary. As public agencies we recognize the importance of this task, and therefore seek a fair, objective and transparent Mercury TMDL. A process based on the best available information, sound science, feasibility, and cost-effectiveness will help establish the legitimacy and legality of the TMDL and the public's confidence.

Over the past five years BASMAA member agencies have attempted to collaborate with Water Board staff on developing information relevant to the mercury TMDL that is based on sound science. This collaborative approach is evident in BASMAA's active participation in the Mercury Watershed Council and more recently in the Clean Estuary Partnership. Unfortunately, Water Board staff has not fully and consistently embraced this collaborative approach. As you know, we have been greatly disappointed by this and have communicated this to you on several occasions. So, we appreciated the opportunity to meet with you recently and hope and expect that our recent discussions are the beginning of a working relationship with you and your staff where we can work through these issues constructively and collaboratively.

Bay Area

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Our most fundamental comment on the Staff Report and Proposed BPA is that both the urban runoff load of 160 kilograms/year, as well as the proposed urban runoff reduction of 78 kg/yr is too large and not supported technically, scientifically, or economically. Below are our significant comments that support that fundamental concern. For each comment we provide the basis for the issue and suggested changes.

Technical Issues

- Based on available information, loading estimates from largest source of mercury to the Bay (i.e., bed erosion) are substantially underestimated, which may have great consequences on the estimated recovery time of the Bay and necessary load reductions assigned to other source categories (i.e., urban stormwater runoff);
- The load reduction proposed in the Staff Report and BPA for urban stormwater runoff, which was developed to meet the proposed sediment target (0.2 mg/kg), is calculated based on inaccurate assumptions and not grounded in sound science; and,
- The assumption regarding the linkage between mercury in sediment and methylmercury in fish is not supported by science so the implications of the assumption are too significant to justify the proposed allocation scheme and implementation schedule; and

Policy Issues

- A significant portion of the estimated current urban stormwater load is likely attributable to an uncontrollable source – indirect air deposition and should be removed from the urban stormwater runoff load estimate and waste-load allocation (WLA) to be consistent with the Water Board's treatment of direct air deposition;
- The proposed requirements and WLA for urban stormwater runoff are technically infeasible to meet, go beyond the maximum extent practicable (MEP) standard and would place an undue burden on urban runoff management programs;
- The WLA for urban stormwater runoff does not factor in projected population growth in the Bay Area, which will increase mercury loads in the future; and
- The proposed Basin Plan Amendment language regarding achievement of the urban runoff allocation needs substantial revision to be acceptable to urban runoff management agencies.

As you know, the proposed BPA has many new proposed requirements that BASMAA member agencies may be required to implement. From our estimates, many of these requirements will be technically infeasible, extremely costly and go beyond the MEP standard. Considering this, suggested improvements contained within this comment letter should be seriously considered and incorporated into a revised BPA and Staff Report. We believe that not doing so will most definitely place an undue burden on public agencies in the Bay Area by requiring implementation actions that will likely have no effect on mercury in the Bay and its biota.

Furthermore, we suggest that the Water Board staff seriously consider revising the Staff Report and BPA to incorporate a Phased implementation approach, similar to that used in the Cache Creek, Bear Creek, and Harley Gulch TMDL for Mercury (CVRWQCB 2004). This approach can be divided into a two-phase process. Phase I may include conducting studies to better determine sources, controllability, and cost effectiveness. Initiating public outreach activities to inform consumers of the potential risks of consuming unsafe amounts of fish may also be included in Phase I. Once a collaborative stakeholder process has developed adequate information, Phase II would begin. Phase II would include the development of implementation plans to further reduce mercury, based on new information collected during Phase I. Without the

phased approach, early implementation of costly management actions that will likely provide little if any benefits to the Bay and its beneficial uses may be required.

Unresolved technical and policy-related issues are further discussed in the balance of this letter.

Technical Issues

1. Based on available information, the mercury load from Bay bed erosion (as presented in the Staff Report) is substantially underestimated

Through our review of readily available information, BASMAA agrees with the Staff Report that bed erosion is likely the largest source of total mercury to the Bay, given past resource management history (i.e., mining) and the likelihood of bed sediments continuing to erode. Therefore, we believe providing the best estimate of bed erosion for the entire Bay is of utmost importance when determining sources of mercury. Unfortunately the Staff Report does not attempt to include bed erosion from segments other than San Pablo and Suisun Bays, as requested in BASMAA's comments on the TMDL Project Report. Water Board staff responded to this request (dated August 25, 2003) with the following statement:

"The desired information is unavailable. We do not intend to speculate in areas where we have no information. This information is being developed, however. Unfortunately, it won't be available in time for the Basin Plan Amendment. Thus we intend to rely on adaptive implementation to incorporate this information when it becomes available".

Information is available and is contained in a recently published USGS open file report (USGS 2004) to estimate bed erosion from the South Bay. In fact, this information was included in the recently published *2004 Pulse of the Estuary* (SFEI 2004). BASMAA believes that without an assessment and quantitative estimate of bed erosion from all segments of the Bay, the largest source of mercury to the Bay is likely to be substantially underestimated, potentially having great consequence on estimated recovery times and necessary load reductions assigned to other sources.

Including this information into the approach used by Water Board staff to estimate overall sources and losses suggests that substantially more mercury (3x more) is attributable to bed erosion than was originally calculated. Furthermore, including this information indicates that the percentage of mercury coming from urban stormwater runoff pales in comparison to that coming from bed erosion. In fact, including bed erosion estimates from the South Bay into the single-box model used to develop the recovery curves presented in the Staff Report (which we do not agree is necessarily representative and appropriate) indicates that Bay sediment would likely meet the proposed sediment target (0.2 ppm) in a much shorter time-frame, even without load reductions.

Suggested Change - We suggest that the source assessment section of the Staff Report and BPA be revised, prior to consideration by the Water Board to adopt the BPA, to include the new information on bed erosion developed by the USGS. Not doing so will drastically underestimate the contribution of mercury from bed erosion and place undue emphasis on other sources, requiring costly management actions that will not substantially reduce mercury in the Bay or speed up the estimated recovery time.

2. The load reduction proposed in the Staff Report and BPA for urban stormwater runoff, which was developed to meet the proposed sediment target, is based on inaccurate assumptions and not grounded in sound science

As raised in comments previously submitted by BASMAA, the methodology used to develop the loading estimate presented in the Staff Report and BPA for urban stormwater runoff is based on inaccurate assumptions and not grounded in sound science. As stated in the Staff Report and BPA, the total mercury load from urban runoff is roughly 160 kg/yr. These estimates were developed on the basis of sediment loads and mercury concentrations in bedded sediment. The estimated total annual sediment loads attributed to urban stormwater runoff is 410 M kg/yr and the estimated average mercury concentration in bedded sediment from urban stormwater runoff is 0.38 mg/kg.

BASMAA believes that the use of bedded sediment data to establish current loading estimates for urban and non-urban storm water runoff introduces very high uncertainty. Furthermore, the San Francisco Estuary Institute (SFEI) has recently stated that it is not possible to determine the bias and error associated with loading estimates based on bedded sediment concentrations (McKee et. al 2003). BASMAA recognizes that there is a lack of sufficient data regarding mercury concentrations in urban stormwater runoff in the Bay Area, which are needed to make loading calculations for the TMDL. Therefore, assuming that uncertainty is formally recognized, it may be possible (on a preliminary basis) to use bedded sediment data to calculate loadings. Notwithstanding any of the previous comments BASMAA or BASMAA member agencies have submitted regarding the use of bedded sediment data to develop loading estimates, we would like to suggest an alternative loading scheme based more on reality. This suggestion is presented in the following paragraphs and supported by the current state-of-science.

Instream vs. Land-based Sediment Sources

BASMAA believes that the estimated total sediment load from urban (410 M kg/yr) areas has been substantially overestimated by a factor of four. Sediment transported to the Bay via small tributaries originates from three source categories; 1) urban stormwater runoff, 2) non-urban stormwater runoff, or 3) “instream and hillslope erosional processes”, such as landslides and channel bank/bed erosion¹. Sediment loading estimates have been developed for urban and non-urban stormwater runoff (Davis et. al 2000; KLI and EOA 2002) using the Simple Method developed by Schueler (1987). Additionally, estimates of sediment production from instream and hillslope processes have been developed for Bay Area creeks (Anderson 1981; Lehre 1981; Leopold 1994; Collins 2001; Stillwater Science 2002). This information is summarized in a recent literature review on urban runoff processes in the San Francisco Bay Area, which states that method used by KLI and EOA (2002) and Davis et. al. (2000) to develop sediment loading estimates from urban and non-urban land use areas is suspected to understate loads by a factor of 2 to 3 (McKee et al. 2003). While we do not disagree with this statement, we would like to clarify our understanding of what the Simple Method is, and is not intended to estimate. The following excerpt is from, *Controlling urban runoff: a practical manual for planning and designing urban BMPs* (Schueler 1987):

“The Simple Method provides a general planning estimate of likely storm pollutant export from development sites. More sophisticated methods, such as watershed and receiving water simulation modeling, may be needed to analyze larger more complex watersheds.”

¹ This differs from the two categories, urban and non-urban runoff, presented in the Staff Report.

Based on Schueler's intended use of the Simple Method, it is not unlikely that sediment loading estimates from Bay Area watersheds underestimated loads to the Bay by a factor of 2 to 3. The estimates made using the Simple Method only estimate the sediment load coming off the surface of the watershed into creeks; not the load being transported to the Bay, which includes sediment from instream and hillslope processes such as bed and bank erosion. This assertion is supported by McKee et. al. (2003) who summarize that sediment is supplied to Bay Area creeks by landslide erosion (38-64%) and bed/bank erosion (8-60%).

BASMAA member agencies have developed new preliminary sediment loading estimates for urban and non-urban stormwater runoff, and instream and hillslope processes. These estimates were developed using the estimated total annual sediment load from small tributaries (810 M kg/yr) that was used in the Staff Report, and loading estimates of total suspended solids (TSS) from urban and non-urban stormwater runoff developed by KLI and EOA (2002)². These revised estimates of sediment loading to the Bay are presented in Table 1.

Table 1. Revised sediment loading estimates from urban runoff, non-urban runoff and instream and hillslope processes

Source Category	Estimated Sediment Loads (M kg/yr)	
	<i>Hg TMDL</i>	<i>BASMAA</i>
Urban Runoff	410	91a
Non-Urban Runoff	400	86a
Instream and Hillslope Processes*	-	633b
<i>Total</i>	<i>810</i>	<i>810</i>
<p>* Includes instream sediment storage, bed and bank erosion, gullyng and landslides</p> <p>a - Sediment loads are based on estimates presented in KLI and EOA (2002) <i>Joint Stormwater Agency Project to Study Urban Sources of PCBs, Mercury and Organochlorine Pesticides</i>.</p> <p>b – Estimated sediment load from this source category = total sediment load (SFRWQCB 2004) - land-based sources (i.e., urban + non-urban)</p>		

Estimated Mercury Concentrations in Sediment

The best available data (see Attachment A) suggests that the average concentration of mercury in creek bed sediment (0.21 ppm) roughly equal to the proposed sediment target (0.2 ppm), and therefore, should not require a load reduction via the TMDL. Considering this, BASMAA has

²Although it is expected that there will be variations in particle size distribution of sediment from urban runoff, recent studies have shown that sediment from urban stormwater runoff is made up of predominantly (90-100%) fine particles that are included in total suspended solid (TSS) measurements (USEPA 1983; Driscoll 1986; and Ball et al. 1995).

developed an alternative total mercury loading scheme based on the best available data. These loading estimates are presented in Table 2 and are intended to assist the Regional Board staff in assigning load and wasteload allocations to the proper sources.

Suggested Change - BASMAA requests that the Staff Report and BPA be revised, prior to consideration by the Regional Board, to exclude mercury and sediment from urban stormwater runoff loading estimates that is attributable to instream and hillslope processes. Mercury and sediment from this source should instead be placed in a separate source category and assigned a separate load allocation (LA). This source category is consistent with USEPA Region 9 *Guidance for Developing TMDLs in California* (2000), which states "...load allocations may be expressed...by pollutant discharge process (e.g., landslides)". Furthermore, due to the average concentration of total mercury in creek bed sediment being equal to the sediment target, the LA for this source should be equal to the current loading estimate. In other words, no load reduction should be required for the channel bed/bank source category.

Table 2. Revised mercury loading estimates from urban runoff, non-urban runoff and instream and hillslope processes

	Estimated Sediment Loads (M kg/yr)		Estimated Hg Concentrations (mg/kg)		Estimated Hg Load (kg/yr)	
	<i>Hg TMDL</i>	<i>BASMAA</i>	<i>Hg TMDL</i>	<i>BASMAA</i>	<i>Hg TMDL</i>	<i>BASMAA</i>
Urban Runoff	410	91a	0.38	0.46b	160	42d
Non-Urban Runoff	400	86a	0.06	0.06	25	5d
Instream and Hillslope Processes	-	633	-	0.21c	-	146
Total	810	810	-	-	185	193
<p>* Includes instream sediment storage, bed and bank erosion, gullyng and landslides</p> <p>a - Sediment loads are based on estimates presented in KLI and EOA (2002) <i>Joint Stormwater Agency Project to Study Urban Sources of PCBs, Mercury and Organochlorine Pesticides</i>.</p> <p>b – Estimated mercury concentrations are derived from sediment collected in Bay Area storm drain facilities (KLI and EOA 2002)</p> <p>c – Estimated mercury concentrations are derived from sediment collected in Bay Area creeks and open channels (KLI and EOA 2002; Gunther et. al 2001)</p> <p>d – These estimates include mercury attributable to indirect air deposition, which should be removed from the urban and non-urban stormwater runoff source categories (see Policy Issue #1).</p>						

3. The assumption regarding the linkage between mercury in sediment and methylmercury in fish is not supported by science so the implications of the assumption are too significant to justify the proposed allocation scheme and implementation schedule.

The linkage analysis and technical foundation of the Bay TMDL for mercury is not supported by the current state of science. From BASMAA's review of the scientific literature, there is no technical basis for assuming that if sediment mercury concentrations are reduced by 50%, then fish tissue and bird egg mercury concentrations will be reduced accordingly. Data from San Francisco Bay do not support this assumption.

The Staff Report acknowledges that, "Factors relating to mercury methylation and accumulation within the food web are complex and not fully understood." However, "In the absence of additional information, reductions in mercury loads are assumed, for purposes of this (TMDL) report, to result in proportional reductions in fish tissue residues (pg. 48)." The report specifically assumes that a reduction in median sediment mercury concentrations in the Bay will produce a proportional reduction in fish tissue mercury concentrations. BASMAA believes the implications of this assumption, which is not supported by the current state of scientific knowledge, are too significant to justify establishing the proposed allocation scheme, and that requiring new implementation actions based on such an unsupported assumption could lead to a significant waste of increasingly scarce public resources. Without, at least, a semi-quantitative understanding of what really controls mercury methylation rates in San Francisco Bay, there can be no confidence that the costly and often unreasonably ambitious sediment mercury target reductions and associated control measures implied by the allocations in the proposed TMDL will produce the desired environmental benefits.

Suggested Change - We recommend that the Water Board postpone consideration of the BPA at this time and instead direct the staff to work with Bay Area stakeholders to substantially revise the Staff Report and BPA, including the incorporation of a phased implementation approach, similar to that used in the Cache Creek, Bear Creek, and Harley Gulch TMDL for Mercury (CVRWQCB 2004). The approach can be divided into a two-phase process. Phase I may include conducting studies to better determine linkage, sources, controllability, and cost effectiveness. During Phase 1, existing NPDES permit requirements; including the mercury reduction plan requirements in municipal stormwater permits would continue to result in enhanced control measures and reduction of mercury discharges. Once the "working hypothesis" that the reduction of total mercury in sediment will reduce methylmercury in fish tissue is tested and affirmed or rejected through a collaborative stakeholder process, Phase II would begin. Phase II would include the development of additional implementation plans to further reduce mercury based on new information collected during Phase I. Without the phased approach, actions to address scientifically flawed allocations and load reduction targets may provide little if any benefits to the Bay and its beneficial uses at significant (and unjustified) public expense.

Policy Issues

- 1. A significant portion of the estimated current urban stormwater load is likely attributable to an uncontrollable source – indirect air deposition and should be removed from the urban stormwater runoff load estimate and waste-load allocation (WLA) to be consistent with the Water Board’s treatment of direct air deposition**

Indirect air deposition of mercury to the San Francisco Bay Area watershed is not a controllable water quality factor and should be removed from the urban stormwater runoff load estimate. The Staff Report includes estimates of dry and wet deposition of mercury directly deposited onto the Bay. However, estimates of indirect deposition onto the watershed are treated to the contrary, assumed to be 100% controllable, and included in the stormwater load estimates.

The Staff Report recognizes the sources of mercury in atmospheric deposition and their relevant contributions are not well understood, but likely include global background sources (e.g., imports from Asia). In assigning a load reduction of zero for direct atmospheric deposition to the surface of the Bay, the Staff Report notes that “...the potential to reduce deposition by controlling local sources is believed to be limited.” Later in the report, Water Board staff go on to say that “In view of the degree to which global (non-local) sources appear to dominate Bay Area air concentrations and presumably deposition, mandated load reductions do not appear appropriate at this time.” Although Water Board staff uses such logic to justify not proposing a reduction in deposition directly to the Bay surface, they do not use that same logic when constructing the urban runoff load or allocation.

These sources are not “reasonably controlled” or likely to be reduced in the near future, and, therefore, should be considered uncontrollable water quality factors – whether deposited on the Bay surface or on the watershed – that are outside the jurisdiction of state and local agencies, including the urban runoff management programs. This approach is also consistent with the narrative objective for bioaccumulation in the San Francisco Bay Basin Water Quality Control Plan (SFBRWQCB 1995):

“Controllable water quality factors shall not cause a detrimental increase in concentrations of toxic substances found in bottom sediments or aquatic life.”

Furthermore, the Staff Report (p. 21) incorrectly states that indirect atmospheric deposition to the watersheds is estimated to be 55 kg/yr. In our review of the SFEI report that was cited for this estimate (Tsai and Hoenicke 2001), the 55 kg/yr is the estimated mass of mercury from indirect deposition to the watershed that likely runs off into local water bodies. This estimate was derived by using an average runoff coefficient of 0.32 for the San Francisco Bay watershed. Back calculating provides us with more correct estimate of roughly 172 kg/yr of mercury that is indirectly deposited onto the watershed, via air deposition.

Suggested Change - We request that the Staff Report be revised prior to consideration for adoption by the Water Board to state that an estimated 172 kg/yr of mercury is annually deposited onto the watershed via indirect air deposition. Additionally, consistent with the Water Board’s treatment of this source of mercury to the Bay itself, the estimated 55 kg/yr of mercury from this source that annually runs off should be removed from the urban and non-urban stormwater load estimates, due to the fact that the source cannot be reasonably controlled.

2. The proposed requirements and WLA for urban stormwater runoff are technically infeasible, go beyond the MEP standard, and would place an undue burden on urban runoff management programs

The BPA proposes requirements and a WLA of 82 kg/yr (48% reduction) from Bay Area urban runoff management programs. The information presented below firmly suggests that these requirements and WLA are technically infeasible, go beyond the maximum extent practicable standard, and would place an undue burden on urban runoff management programs.

Technical Feasibility and Costs of Meeting the Proposed Wasteload Allocation (WLA)

With regard to reducing the mass of mercury entering the Bay, theoretically, urban runoff management programs will likely be called on to use one or more control and/or treatment options described below. However, as demonstrated, the implementation and success of many of these options is likely limited, due to technical infeasibility and extremely high capital costs and ongoing implementation costs (see Table 3).

A summary of each possible control option, its technical feasibility, likelihood of success and anticipated costs are briefly described below.

- Recycling Programs – includes developing recycling programs, operating recycling facilities and promoting the recycling mercury containing devices such as fluorescent light bulbs, thermometers and mercury switches.
- Source Controls – includes developing programs that remove mercury latent sediment from municipal storm drain facilities and creek channels.
- Treatment Controls – includes developing and implementing mechanisms that capture and treat stormwater through the removal of fine sediment.

Recycling Programs

Estimates developed by SCVURPPP indicate that currently in the Bay Area, between 11 and 30 kg/yr of mercury in the Bay Area is recycled annually from fluorescent light bulbs³ (ALMR 2003). However, as shown in previous studies, only a portion of this mercury (1-20% or 0.1 to 6 kg/yr) may actually be released into the environment through volatilization⁴ (USEPA 1994; NEMA 2000; Aucott et al. 2003). To determine the extent to which recycling fluorescent light bulbs could aid urban runoff management programs in meeting the proposed load reduction (78 kg/yr), BASMAA has estimated that if every fluorescent light bulb purchased in the Bay Area were recycled, the load of mercury that would be avoided from entering the environment is between 1 and 20 kg/yr⁵ (ALMR 2003). In other words, not taking into account technical feasibility or costs, only between 1-26% of the mercury load reduction required from urban stormwater runoff could be accounted for through fluorescent light bulb recycling.

³ Estimates are based on the following assumptions: 1) 2,892,000 bulbs recycled annually in the Bay Area by businesses and households combined (ALMR 2003) and, 2) 4 to 10 mg of mercury per light bulb (ALMR 2003; NEMA 2000).

⁴ Estimated 1 to 20% mercury volatilization rate.

⁵ Estimates are based on the following assumptions: 1) 12,000,000 bulbs purchased/disposed of annually in the Bay Area by businesses and households combined (ALMR 2003); 2) 4 to 10 mg of mercury per light bulb (ALMR 2003; NEMA 2000); and, 3) 1-20% mercury volatilization rate (USEPA 1994; NEMA 2000; Aucott et al. 2003)

Costs estimates associated with increased recycling of fluorescent light bulbs and other mercury containing devices (e.g., thermostats and switches) have been recently developed by BASMAA member agencies (i.e., Santa Clara County and City of Palo Alto). Infrastructure and operating costs of handling increased quantities of these devices by Santa Clara County's Household Hazardous Waste (HHW) Program could exceed \$10 million per year (D'Arcy 2002). Additionally, the City of Palo Alto (2003) has estimated that the average cost of recycling each fluorescent light bulb is approximately \$0.51. Therefore, based on these cost estimates, the estimated number of fluorescent light bulbs that are purchased/disposed of by households in the Bay Area each year (~1.8 million), and the assumption that each of the seven BASMAA member agencies would accrue similar costs, the total cost for BASMAA member agencies combined would be significant (\$70 million annual capital costs and \$9 million annual maintenance and reporting costs). These costs do not take into account the technical feasibility of collecting, shipping and recycling these wastes and do not include the costs of tracking and reporting recycling activities conducted by businesses (i.e., large waste generators).

Source Controls

Mercury Source Control Program

As you know, BASMAA member agencies have spent a significant amount of resources and staff time in recent years on developing and implementing a Mercury Pollution Prevention Plans (Mercury Plans), per NDPES permit requirements. BASMAA assumes that the "Source Control Program" requirement for urban runoff management programs listed in the BPA will be met through the implementation of previously developed and implemented Mercury Plans. Under this assumption, the BASMAA has estimated costs for developing and implementing Mercury Plans, based on the costs accrued by one member agency (SCVURPPP). These costs include:

- Plan Development and Initial Outreach - Direct costs to the SCVURPPP to set up the mercury pollution prevention program and perform the initial outreach were \$25,000. Indirect costs to the SCVURPPP co-permittees to set up the program were approximately \$120,000.
- Implementation of Plan - This step involves development of policies, guidelines, and model ordinances. The SCVURPPP has allotted \$60,000 as the direct cost for program implementation. Additionally, indirect costs are incurred by co-permittees through the use of their own staff time. The SCVURPPP estimates that the implementation of the pollution prevention program costs SCVURPPP co-permittees \$120,000 initially and will cost an additional \$240,000 annually.

Therefore, the estimated total cost of developing and implementing Mercury Plans for all seven BASMAA member agencies combined is roughly \$1.8 million for development and \$2.1 million annually to implement.

Additional Source Controls

Given the relatively low mass of mercury that could be removed via recycling programs and the extremely high costs associated with implementing these programs, it is likely that the BASMAA agencies will be required to increase the extent of source control activities to meet the proposed WLA. Additional source controls (with regard to mercury) are those activities that involve the removal of sediment (and therefore mercury) during storm drain facility and creek/channel maintenance, and street sweeping. All BASMAA agencies currently implement source controls as part of their urban runoff management programs. However, as structured, the WLA and implementation plan will provide no credit for these activities even though they reduce mercury from entering the Bay.

In an attempt to further examine the feasibility and costs associated with increasing additional source control activities, we have developed preliminary estimates of the mass of sediment that would have to be removed via source controls to meet the proposed WLA for urban stormwater runoff (Bay-wide). Opportunities for additional source control activities were focused on controls (i.e., storm drain facility and channel/creek maintenance) that have been shown in recent studies to have the greatest potential for removal of an additional mass of mercury (Salop et al. 2004). Based on available information, we estimate that in order to meet the proposed WLA for urban stormwater runoff (82 kg/yr), BASMAA agencies would have to remove an additional 200 million kilograms of sediment per year from storm drain facilities and/or creeks/channels⁶.

The best available data (see Attachment A) suggests that the average concentration of mercury in creek /channel bedded sediments (0.21 ppm) is roughly equal to the proposed sediment target (0.2 ppm), and therefore the removal of these sediments would not substantially aid the recovery of the Bay. Taking this into account, we developed estimates of the mass and volume of material that would have to be removed from municipal storm drain facilities to meet the proposed WLA. Since only a portion (~25%) of the material typically removed from storm drain facilities is actually sediment, it is estimated that BASMAA member agencies would actually have to remove and dispose of an additional 800 million kilograms of material per year from storm drain facilities. This mass of material equates to 1.4 million yd³ or 47,000 30-yd³ truck loads of material annually⁷. This is roughly a 500% increase from current storm drain maintenance activities. The technical feasibility of removing this volume of material annually from the municipal storm drain facility is highly questionable, considering that this volume of material probably does not exist⁸.

Regardless of technical feasibility, the costs associated with removing, hauling and disposing of this material is prohibitive. Preliminary estimated costs for BASMAA member agencies to conduct additional source control activities, in response to the mercury TMDL are estimated to be approximately \$50 million in capital costs (annualized to 3.5 million per year for 25 years @ 5% interest) and \$85 million in annual operating costs⁹.

Treatment Controls

Stormwater treatment controls are methods of treatment to reduce pollutants from stormwater. Treatment methods typically include the infiltration, retention or filtering of stormwater. For the purposes of this discussion, treatment controls fall into one of two categories: 1) Treatment Control Measures, and 2) Diversion of Stormwater Flows to Wastewater Treatment Plants.

It is important to note, the assumption that new and redevelopment requirements (i.e., C.3.) will offset future increases in mercury from the increased population is unrealistic and unsubstantiated. A large majority of Bay Area cities are promoting smart growth, which encourages people to live in metropolitan hubs and urbanized areas where impervious surfaces

⁶ Estimate is based on a 49% decrease in the estimated 410 M kg/yr sediment load that contains an average mercury concentration of 0.38 mg/kg (ppm)

⁷ Estimate is based on a sediment mass to volume conversion factor of 570 kg per yd³

⁸ Preliminary estimates based on 91 kg/yr of annual TSS loading from urban areas (KLI and EOA 2002) and assuming that roughly 25% of the material in storm drain facilities is sediment (Salop et al. 2004) indicate that only an estimated 400 million kilograms of material may be entering the municipal storm drain system annually

⁹ These costs are based purchasing, operating and maintaining vector trucks; constructing and operating storage facilities; hauling; staffing; and, waste disposal in a municipal landfill.

are already present. As you know, new and redevelopment requirements appropriately do not apply to such urbanized and highly developed areas, as they would otherwise create incentives for sprawl.

As noted in many previous studies, reports and guidance manuals, most treatment controls are extremely inefficient at removing fine sediment (and therefore mercury) during the treatment process and require ongoing maintenance (Metropolitan Council 2001; VCSQMP 2002; CASQA 2003). Those typical treatment controls that have shown efficiency in removing fine sediment are typically large in size (> 1 acre), due to the relatively long residence time needed to allow fine/suspended sediment to be removed from the water column through settling. Other treatment controls will likely require the construction of additional infrastructure (e.g., stormwater treatment plant). The technical feasibility and estimated costs of constructing, operating and maintaining these treatment controls are described below.

Treatment Control Measures

Structural treatment control measures treat incoming stormwater by settling and should usually hold water for at least 24-72 hours. These design standards for maximum pollutant removal efficiency indicate that a large area (>1 acre) is needed if effective treatment is to occur. Therefore, the implementation of treatment controls such as wet ponds, and detention and infiltration basins is technically infeasible in most urbanized areas of the Bay, due to the lack of undeveloped land area on which such facilities would need to be constructed.

Costs of constructing and maintaining treatment controls vary. Without considering the costs of purchasing land needed to construct treatment controls, Minton (2003) estimates that the cost of constructing a wet pond can range between \$1,600 and \$9,000 per acre of development. Additionally, it is likely that land costs in the urbanized areas of the Bay Area can exceed \$1 million per acre. Although little information was available to estimate operation and maintenance costs, they are believed to be substantial, ongoing and likely much higher than construction costs.

Diversion of Stormwater Flows to Wastewater Treatment Plants

This strategy would divert urban runoff to wastewater treatment plants for removal of mercury (LWA 2002, Abu-Saba 2002). Based on currently available information, it appears highly unlikely that stormwater could feasibly be diverted to existing treatment plants, without substantial retrofits to the treatment plant infrastructure. This is due to the lack of existing plant capacity and the timing of diversion (i.e., early season rains and first flush events)¹⁰. These retrofits would include, at a minimum, increasing plant capacity and constructing new sanitary sewer lines. Preliminary costs estimates of implementing these retrofits (excluding land, additional piping, pumping costs, flow equalization/detention basins and recognizing the difficulties of urban and non-urban runoff) are between \$261 million per year for primary treatment (i.e., \$146 million /year for O&M and \$115 million per year capital) and \$347 million per year for primary plus filtration (i.e., \$194 million per year for O&M and \$153 million per year for capital)¹¹.

¹⁰ Sanitary sewer collection systems and wastewater treatment plants are often designed with capacity exceeding that needed to accommodate dry weather flows. The extra capacity typically is used to treat increased wet weather flows caused by inflow and infiltration into the collection system and to accommodate population growth in a community.

¹¹ Preliminary cost estimates are based on treating the flow volume for annual runoff (Davis, J.A. 2000) estimated for watersheds draining to the Bay at approximately 600,000 acre-ft/year and utilizing updated primary and primary+filtration unit costs for wastewater treatment (UC Davis, 1992). Unit costs of

Urban Stormwater Runoff Source Investigations

Initiating and implementing special studies to determine the spatial extent, magnitude, and locations of potential *de minimus* sources of mercury in urban stormwater runoff can be an expensive, time consuming and unfruitful experience. Furthermore, the number of and extent of studies that will be required is currently unknown, but could include all sites where previous studies have determined that mercury concentrations in storm drains or creeks/channels exceeded the proposed 0.2 mg/kg sediment target (i.e., ~56 sites)¹². Based on previous experience conducting PCB Case Studies, the estimated cost of each of these studies is between \$10,000 and 100,000 annually, suggesting an annual cost between \$560,000 and \$5.6 million Bay-wide.

Monitoring System

The proposed BPA includes a requirement for urban runoff management programs to develop and implement a monitoring system to quantify either mercury loads or the loads avoided through treatment, source control, and other management efforts. Although the scope and extent of the monitoring system is not fully understood, we anticipate that this requirement will include both ambient environmental monitoring and monitoring loads avoided/removed from recycling programs, source controls and treatment controls. It is estimated that environmental monitoring conducted solely for mercury will likely cost BASMAA agencies between \$700,000 and \$1.5 million annually, due to the level of precision needed to develop accurate loading estimates from tributaries to the Bay. Additionally, monitoring loads avoided/removed from implemented controls is estimated to cost roughly \$800,000 annually. Therefore, the total estimated cost for BASMAA to meet this requirement is between \$1.5 and \$2.3 million annually.

Fate, Transport, and Biological Uptake Investigations

BASMAA assumes that this requirement can be satisfied by participating in the Regional Monitoring Program for Trace Substance and/or the Clean Estuary Partnership at our current level of funding. If this assumption is correct, the estimated cost of complying with this requirement would be equal to current annual contribution to the RMP and CEP combined (~\$1.25 million), plus the costs of staff time (~\$250,000) needed to participate in and track these programs (i.e., total costs to BASMAA = ~\$1.5 million annually). These costs do not include contributions to the RMP and CEP from BASMAA agencies that own and operate POTWs. Any additional studies requiring funding or staff time would substantially increase costs.

Caltrans Allocation-sharing Scheme

Developing WLAs for dischargers covered by NPDES permits is not the responsibility of municipal urban runoff management programs. BASMAA member agencies have no jurisdiction over Caltrans activities.

Suggested Change - While we do not disagree that Caltrans should be addressed under this TMDL and the BPA, we request that the approach currently recommended by staff be revised to include a separate WLA specifically for Caltrans.

\$100,000 per acre-ft./day for primary plus filtration and a unit cost of \$78,000 acre-ft/day for primary treatment were used. The unit treatment costs were escalated to 2004 dollars and annualized over a twenty year period (i.e., includes capital plus O&M). The annual cost for O&M is roughly 56% of the total. The annualized cost for capital is based on a 25 year term at 5% interest.

¹² Identified sites may be only a small portion of the sites that contain mercury above the sediment target. Therefore, costs could be much greater than estimated.

Annual Report Preparation

If the BPA is approved, then BASMAA agencies will be required to prepare an annual report that measures progress towards achieving the WLA and documents either mercury loads or loads avoided through ongoing pollution prevention and control activities. While the above indicates that there is no reasonable prospect of addressing the BPA's unrealistic load reduction targets for urban runoff even with enormous public investment, we estimate that the development of specialized reporting forms documenting this likely outcome (and concurrently serving as a target for criticism and potential third party legal action) will cost roughly \$175,000 initially, while ongoing staff time needed to prepare annual reports will cost the roughly \$250,000 annually.

Summary of Estimated Costs

Total estimated costs for BASMAA agencies to meet the proposed WLA and requirements presented in the Staff Report and BPA are between \$107 and \$167 million for capital costs and between \$94 and \$127 million in annual costs. A summary of these costs is presented in the in Table 3.

Table 3. BASMAA's Estimated Costs of Complying with the Proposed WLA and Requirements for Urban Runoff Management Programs

Control/Requirement	Annual Capital Costs(*)	Annual Ongoing Maintenance & Reporting Costs
Recycling Programs	\$ 70 million	\$ 11 million
Source Controls	\$ 3.5 million	\$ 85 million
Treatment Controls		
<i>Treatment Control Measures</i>	Unknown	Unknown
<i>Diversion to POTWs</i>	\$115 million per year (primary) to \$153 million per year (primary plus filtration)	\$146 million per year (primary) to \$194 million per year (primary plus filtration)
Source Investigations	-	\$560,000 to 5.6 million
Monitoring System	-	\$ 1.5 to 2.3 million
Fate/Trans/Uptake Studies	-	\$ 1.5 million
Allocation Scheme	Unknown	Unknown
Annual Reporting	\$12,000	\$250,000
Total Costs¹³	\$188 to 226 Million	\$246 to 300 Million

* Annual Capital Costs are annualized over a 25 year term at a 5% interest rate. It may be possible to remove some or all of the source control costs for sediment removal and disposal depending on the flow and treatment assumptions utilized for modification and/or building new facilities, however all costs are at this point in the analysis.

¹³ Total costs presented in Table 3 and within the text are a summation of the estimated costs for all treatment and source controls presented. It is feasible that all controls will not need to be implemented simultaneously. In this case, estimated total costs may be less than presented.

Suggested Change - The Staff Report's economic analysis is insufficient and substantially underestimates the costs of meeting the proposed WLA. We request that a more rigorous review of the true costs and benefits be included in a revised version of the Staff Report and BPA prior to consideration for adoption by the Water Board. This analysis should be conducted as required by section 13242 of the California Water Code.

3. The WLA for urban runoff does not fully consider projected population growth in the Bay Area, which will most likely increase mercury loads in the future

The population in the Bay Area is estimated to increase 14% by 2025 (ABAG 2004). Mercury in urban stormwater runoff is believed to partially originate from local air sources (e.g., fluorescent bulb breakage), which will likely increase with the increased population. The proposed wasteload allocation (WLA) for urban stormwater runoff does not factor in projected growth, as often is done in TMDLs. As suggested by Dr. Sedlak's peer review comments on the Staff Report and BPA, we suggest that the Water Board staff address the issue of future increase of mercury concentrations entering the Bay via growth. Additionally, the WLA for urban stormwater runoff should be revised to include these inevitable increases.

4. The proposed Basin Plan Amendment language regarding achievement of the urban runoff allocation needs substantial revision to be acceptable to urban runoff management agencies

Based on our recent meeting, we expect there to be considerable further discussion on the proposed Basin Plan amendment language so we will reserve most of our comments until then. However, we feel compelled to make one comment regarding the current proposed language. The proposed language includes a requirement that the urban runoff allocation shall be achieved within 20 years. Based on the best professional judgment of urban runoff management agencies, there is no technical, scientific, or economic basis for assuming or projecting that the proposed allocation for urban runoff will be achieved in 20 years. Such a timeframe is highly speculative and therefore should not be the basis of an absolute requirement. Phrasing the implementation schedule in such a definitive way in such a formal document as a Basin Plan is inappropriate.

Suggested Change – We propose phrasing the language in a way that maintains its intent while more accurately recognizing the lack of basis for establishing the actual timeframe for achieving the allocation.

BASMAA Comments – Mercury in San Francisco Bay TMDL Staff Report and Proposed Basin Plan Amendment

We hope you find these comments and suggested improvements to the Mercury TMDL Staff Report and proposed Basin Plan Amendment useful. Due to the significance of our comments and following up on our meeting with you, BASMAA representatives look forward to working together with you and other Water Board staff to address our concerns and incorporate the suggested changes into a revised Staff Report, BPA, and implementation plan.

Please contact me at (925) 313-2373 if you have any questions regarding the comments or suggested changes.

Sincerely,

A handwritten signature in black ink, appearing to read "Donald P. Freitas". The signature is fluid and cursive, with a large, stylized initial 'D' and 'F'.

Donald P. Freitas
BASMAA Executive Board Chair

cc: Arleen Feng, BASMAA Monitoring Committee
Jim Scanlin, ACCWP
Kevin Cullen / Larry Bahr, FSURMP
Liz Lewis, MCSTOPPP
Bob Davidson, SMCSTOPPP
Adam Olivieri, SCVURPPP
Emily Dean, SCWA
Jack Betourne, VSFCD
Chris Sommers, CEP Mercury Work Group
Geoff Brosseau, BASMAA
Tom Mumley, SFBRWQCB
Dyan Whyte, SFBRWQCB
Richard Looker, SFBRWQCB
Bill Johnson, SFBRWQCB
Dale Bowyer, SFBRWQCB
Andy Gunther, Clean Estuary Partnership

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Attachment A

Total Mercury Concentrations from Bedded Sediments Collected in Open Channel/Creek Substrate (KLI and EOA 2002; Gunther et al. 2001)

Site	Total Mercury (mg/kg)	Land Use	Site	Total Mercury (mg/kg)	Land Use
CCC001	0.47	Industrial	SMC029	0.63	Res/Com
CCC009	0.07	Industrial	SMC030	0.66	Res/Com
CCC020	0.14	Industrial	SMC031	0.18	Res/Com
CCC026	0.47	Industrial	VFC001	0.18	Res/Com
CCC029	0.07	Industrial	VFC002	0.15	Res/Com
CCC030	0.63	Industrial	VFC010	0.57	Res/Com
FSS001	0.06	Industrial	Arroyo Viejo	0.04	Mixed
FSS006	0.12	Industrial	San Lorenzo		
MCS009	0.22	Industrial	S.B.	0.13	Mixed
MCS012	0.38	Industrial	Castro Valley S-		
SCV044	0.05	Industrial	3	0.08	Mixed
VFC004	0.33	Industrial	Line 6-G,		
CCC016	0.15	Mixed	Chevron	0.14	Mixed
CCC017	0.11	Mixed	San Leandro		
CCC018	0.1	Mixed	Creek	0.26	Mixed
MCS002	0.36	Mixed	Seminary Creek	0.16	Mixed
MCS003	0.05	Mixed	Lion Creek	0.29	Mixed
MCS004	0.09	Mixed	Alameda Creek	0.11	Mixed
MCS006	0.27	Mixed	Laguna Creek	0.11	Mixed
SCV021	0.12	Mixed	Cabot Creek	0.11	Mixed
SCV024	0.05	Mixed	Aqua Caliente	0.17	Mixed
SCV041	0.03	Mixed	Castro Valley	0.06	Mixed
SCV042	0.06	Mixed	Cerrito Creek	0.34	Mixed
SMC010	0.06	Mixed	Glen Echo	0.17	Mixed
SMC012	0.05	Mixed	Sausal Creek	0.31	Mixed
SMC013	0.11	Mixed	Crandall Creek	0.12	Mixed
SMC028	0.05	Mixed	Scott Creek	0.15	Mixed
VFC009	0.42	Mixed	Strawberry		
CCC012	0.03	Res/Com	Creek	0.05	Mixed
CCC019	0.19	Res/Com	Dry Creek	0.04	Mixed
FSS003	0.02	Res/Com	Balentine Drive	0.1	Mixed
MCS013	0.21	Res/Com	Codornices	0.49	Mixed
SMC005	0.2	Res/Com			
SMC024	1.31	Res/Com			

Average Hg Concentration in Open Channel Sites = 0.21 mg/kg (ppm)



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Ellen Joslin Johnck
Executive Director

June 14, 2004

Mr. Bill Johnson, Environmental Scientist and
Mr. Richard Looker, Water Resources Control Engineer
San Francisco Bay Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

Re: Mercury in San Francisco Bay – TMDL Basin Plan Amendment--Dredged Material

Dear Messrs. Johnson and Looker,

The Bay Planning Coalition (BPC) is pleased to submit comments on the Mercury in San Francisco Bay, TMDL Basin Plan Amendment. The development of a TMDL is a very complex scientific and policymaking process, and BPC congratulates the RWQCB on this accomplishment. Below are some comments on the TMDL approach focused on dredged material which BPC recommends should be incorporated into this Basin Plan amendment and future TMDL reports and amendments.

General accounting of sources and losses

BPC agrees with your general accounting of sources and losses of mercury in the Bay for dredged material. Specifically we would like to emphasize our agreement that in-bay dredging and disposal has a net zero loading allocation, that out-of-bay disposal of dredged material is considered a net loss, and that the LTMS strategy is part of the solution. We also agree that the natural transport of sediment through the Golden Gate is considered a net loss.

Sediment Dredging and Disposal Allocations

The TMDL states that the proposed allocation for in-bay disposal of dredged sediment is concentration-based and is not to "...exceed the baywide ambient median suspended sediment mercury concentration from all RMP bay monitoring stations". We are concerned about how the RWQCB defines ambient conditions. The concept of an allocation based on ambient in-Bay concentration is subject to serious statistical problems in implementation. As applied to dredged material disposal decisionmaking, this definition must be (1) scientifically accurate, reflecting the variable and dynamic conditions of the Bay; (2) integrated with and consistent with the philosophy and regulatory decision-making guidance applied by the Dredged Material Management Office (DMMO) – the collection of regulatory agencies that permit dredging activities in the Bay – and their determination of suitability for in-bay disposal; and (3) achievable in terms of analytical methodologies.

We recommend that you return to the LTMS implementation strategy as a basic tool for the purpose of the TMDL as distinguished from relying on a concentration-based limitation. We would like to continue to work with you to reach agreement on a definition of ambient that meets our three objectives above. For your further review, the Port of Oakland has also identified and elaborated on these technical concerns for the purpose of reaching agreement on the definition for "ambient sediment" with which

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Port of Oakland

Ellen Joslin Johnck
Executive Director

BPC agrees. We understand that the Port of Oakland has initiated discussion of this topic with RWQCB staff, and we would like to continue to participate in this dialogue.

TMDL Implementation - Proposed new permit requirements

The Mercury TMDL implementation plan proposes the imposition of new requirements on dredging permits "...to investigate the potential for dredging to enhance mercury uptake into the food web". These proposed requirements, however, are not defined in the proposed Basin Plan amendment; and so we presume that this proposal is primarily for discussion purposes and is not intended as a new regulation. It appears that the general aim is to bring scientific certainty to unknowns about the propagation and impact of mercury or methylmercury throughout the Bay. We would be opposed to additional permit requirements, as permittees are already contributing to the Bay scientific knowledge base through their mandatory financial contributions to the S. F. Estuary Institute's Regional Monitoring Program (RMP). While we understand the need to determine the impact of mercury on Bay health, we recommend that it may be more appropriate that general studies be conducted and funded by established programs such as the RMP.

Again, we would like to commend the RWQCB on their tremendous efforts and accomplishments in the TMDL process. We look forward to participating in the TMDL program in the future to ensure the integration of sound science and the balancing of economic and environmental policy goals.

Sincerely yours,

Ellen Joslin Johnck
 Executive Director

Cc: LTC Michael McCormick, S. F. District Engineer, U. S. Army Corps of Engineers
 Ms. Alexis Strauss, Director, Water Division, U. S. Environmental Protection Agency,
 Region IX
 Mr. William Travis, Executive Director, S. F. Bay Conservation and Development
 Commission

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June 14, 2004

Mr. BRUCE WOLFE, Executive Officer
California Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, CA 94612

Attention: Mr. Bill Johnson

Dear Mr. Wolfe:

The current draft staff project report for "Mercury in San Francisco Bay, Total Maximum Daily load" and proposed Basin Plan amendment includes provisions pertaining to the Departments' responsibility for reducing mercury loads to San Francisco Bay. We are supportive in efforts to improve water quality in the Bay, but concerned with the proportional allocation, numeric targets and implementation plan that is proposed for the Department.

The Department disagrees with the approach of determining our allocation based on a percentage of each urban stormwater discharger's mercury load. This approach does not recognize current monitoring data for roadway runoff, watershed area contributing to runoff and the minimal significance of roadway runoff as a major source of mercury. Therefore, the Department requests that the determination of the allocation be based on data specifically associated within the Department Right-of-Way and not solely based on an equitable allocation scheme associated with each urban stormwater discharger.

The Basin Plan amendment acknowledges that *"assigning loads by watersheds could be a useful approach to managing pollutant loads....."*. We believe that this concept is directly applicable to the Department. Approximately 27 square miles of Department right-of-way within Region 2 drains to the San Francisco Bay. This area represents only 0.7% of the total watershed (4,000 square miles) that flows to the Bay. Given that less than 1% of the runoff into the Bay within Region 2 is from the Department's watershed, our equitable annual loading and share allocation must be based on tangible data.

It is important that the Board include in this Basin Plan amendment a revision for the Department that is based on new evidence that supports a watershed-based allocation. The Department proposes to implement studies to clarify mercury loading in association with roadway runoff. With these studies in place, the TMDL for mercury assigned to the Department can be modified based on reliable and accepted information. The methodologies and data in the Boards' draft project report related to quantifying mercury loading in various discharges currently lack specific information

Mr. Bruce Wolfe

June 11, 2004

Page 2

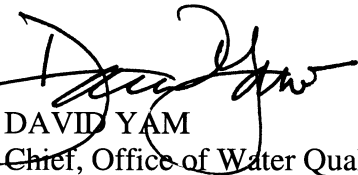
related to quantifying mercury loading in various discharges currently lack specific information related to roadways as a source of mercury loading. Based on these findings, numeric targets and an implementation plan can be developed that recognizes the Boards' objectives of reducing mercury loading. Attached to this letter are additional comments that support our position.

The Basin Plan amendment provides alternatives and flexibility in reaching goals for reduction in Mercury loads. The Department will work in cooperation with other urban dischargers and the Board to find equitable ways to reach our fair reduction goals. However, our responsible load determination and share allocation must not be exclusively tied to percentages associated with other urban discharger's mercury load. Our current efforts in implementing construction and post-construction (Pollution Prevention and Treatment) Best Management Practices (BMPs) indicates our commitment to improving water quality in compliance with our Statewide NPDES permit. We feel that these BMPs are reducing erosion and sediment loading and should be recognized as already contributing to reductions in the mercury loading.

Future monitoring may result in substantial changes to the estimates of the stormwater runoff contribution to San Francisco Bay mercury loading. The TMDL allocated to the Department needs to clearly recognize these changes.

Thank you for the opportunity to comment. If you have any questions, please contact me at (510) 286-5662.

Sincerely,

A handwritten signature in black ink, appearing to read "David Yam", is written over the printed name and title.

DAVID YAM

Chief, Office of Water Quality and Mitigation

Attachment: Additional Comments Supporting the Department's Position

Attachment

Department of Transportation Letter to:

California Regional Water Quality Control Board
San Francisco Bay Region

Re: San Francisco Bay Mercury TMDL - Draft Basin Plan Amendment (April 30, 2004)

June 14, 2004

This attachment provides additional comments on the TMDL documents.

1. **Mercury concentration in roadway runoff** - The available monitoring data appear to indicate that Department facilities are not a major source of the mercury entering the bay. Mercury concentrations measured during the statewide stormwater quality characterization study found that mercury in roadway runoff averaged 37 ng/l (total). The CTR criterion for mercury is 51 ng/l (dissolved) and the Basin Plan's objective is 25 ng/L.
2. **Flexibility for Caltrans** – We are concerned that some jurisdictions may assign Caltrans a sub-allocation based on an arbitrary value such as percentage of flow, which may not represent Caltrans actual contribution. If this occurs, Caltrans would have extreme difficulty demonstrating the required reduction in mercury mass loading because virtually none of the proposed municipal implementation options are available to Caltrans (e.g., fluorescent light bulb diversion, thermometer collection). We propose that the TMDL specifically state that the Caltrans allocation will be based on data representative of Caltrans actual contribution to the mercury loading, preferably on a watershed basis.
3. **Lack of feasible options for achieving allocations given to stormwater sources** – As currently drafted, municipal stormwater sources are expected to reduce their mercury loadings by almost 50%. The TMDL relies on “adaptive implementation” – that is, the dischargers are asked to provide the Board with information on feasibility, effectiveness and costs. The goal is that this cooperative approach will lead to the identification of appropriate controls. Cleanup of watershed “hot spots” has been postulated as one likely control. The other postulated controls include pollution prevention activities such as collection of mercury-containing devices. Unfortunately, there is very little evidence that hot spots exist such that focused soil removal could achieve the desired major reductions in mercury in runoff. Additionally, it seems very unlikely that such hot spots are present on Caltrans property. We are concerned that Caltrans will not be able to demonstrate the required reductions (loads avoided) because there are quite possibly no hotspots in the right-of-way and runoff concentrations appear to already be low.

In the absence of appropriate discharger-specific controls, some permittees such as Caltrans will be faced with two alternatives: (1) provide retrofit treatment controls at runoff locations, or (2) purchase equivalent load reductions elsewhere. We believe

that neither of these likely outcomes have been adequately discussed in the TMDL documents or represented in the cost estimates.

We propose that the TMDL not proceed until realistic reduction alternatives are identified and assessed. These alternatives should include the retrofit construction of treatment facilities and a reduction-credit purchase program, which we see as the likely result of this TMDL.

4. **Background and other unavoidable loading** – The TMDL appears to assume that background soil concentration values are approximately 0.06 ppm based on the Santa Clara sampling of agricultural areas. We believe this value may be low based on the University of Riverside's compilation of trace element concentrations in 50 different soils from around the state (*Background Concentration of Trace and Major Elements in California Soils*, G.R. Bradford, et. al., 1996). This report showed a geometric mean concentration of mercury in uncontaminated soils of 0.2 mg/Kg and a relatively wide range. Several soil mercury concentrations were above 0.4 which is significantly above the goal for the Bay. Thus, in some areas, dust from local soils could cause the roadway sediment to exceed the goals.

An additional factor is aerial fallout which potentially contributes significantly throughout the watershed but is not controllable except by treatment of runoff.

Our concern is that that natural (uncontaminated) background soil concentrations of mercury plus aerial fallout may be the major contributors to roadway mercury. As discussed in the previous comment, the suggested controls of pollution prevention and hot spot removal will not address these sources.

5. **Economic assessment** – We believe the economics in the basin plan amendment may substantially understate the potential costs of the TMDL. This draft estimates \$2 million initially and additional \$3M per year thereafter, for stormwater. These costs do not seem realistic. If achieving adequate loading reductions requires the construction of end-of-pipe treatment facilities or the purchase of offsets, then the costs may be higher than estimated. The Board assumes that non-structural measures will provide substantial benefit, however we do not see how any of these would be applicable to the Department.

We propose that the TMDL specifically identify the costs of reduction alternatives that are realistically available to the Department

6. **Need to assess cumulative costs and engineering compatibility of this and other Bay TMDLs** – We are concerned that the Board has not examined the cumulative cost and technical implications of this TMDL combined with possible future TMDLs in the Region. The problem we see is that while some initial TMDLs may be fundable, the full set of TMDLs may be beyond available public resources. Our related concern is that controls implemented for the initial TMDLs may not be compatible with subsequent TMDLs.

The current 303(d) listing means that stormwater runoff agencies will have substantial burdens in achieving waste load allocations for mercury, as well as PCBs, dioxin, and the legacy pesticides. It is also possible that other constituents may be listed. For example, the Los Angeles Board and other Boards have possibly been more aggressive in their approach to listing and have included "trash" and bacteria, for example, as contributing to impairment

of their waterways. We presume there is a likelihood that these constituents, along with other typically listed constituents, may eventually be listed and require TMDLs in San Francisco Bay.

In addition to cumulative costs, we see an issue of treatment compatibility. If treatment controls are required, the controls build for the initial TMDL constituents may not be compatible with the controls needed to attain reductions for subsequent TMDLs. For example, a retrofit stormwater control facility for mercury reduction will need to be designed differently if it ultimately will need to address trash or bacteria.

We propose that the Board provide an estimate of the costs applicable to stormwater dischargers for achieving the expected allocations for the currently listed constituents. In addition, a supplemental cost estimate should identify a range of costs for achieving compliance with other constituents that the Board believes may potentially be placed on the 303(d) list.

We also proposed that the TMDL provide an assessment of the compatibility of the controls likely to be implemented for the whole suite of TMDLs. The final result of this overall assessment may be a prioritization based on the most cost effective reduction of those constituents presenting the greatest environmental risk.

7. **Need for a broader approach to mercury control including atmospheric deposition** – Recent work in Lake Tahoe has found that sediments in the lake have concentrations of mercury averaging 0.191 ppm. This is a five-fold increase over the mercury present in the local bedrock. This is essentially the same concentration as the sediment goal for San Francisco Bay. The source of the metal is presumed to be direct atmospheric deposition primarily from regional and global sources. Mercury tends to preferentially settle out at high, cold elevations, and so atmospheric deposition in coastal areas will be less. However, this Tahoe data indicates that atmospheric deposition is widespread and potentially significant. (See <http://trg.ucdavis.edu/research/annualreport/contents/lake/article11.html>)

The TMDL discusses atmospheric deposition as it directly affects the Bay and local watershed but does not propose any reductions in this deposition. The TMDL estimates that as much as 30% of the stormwater loading may result from atmospheric deposition. Since the TMDL acknowledges that deposition contributes substantially to mercury concentration in surface soils it should more aggressively consider control opportunities. It may be appropriate for the SWRCB to address some of the regional sources through legislation or coordinated action with the Air Resources Board. (For example, controls on crematoria and car dismantlers could be considered.) As noted in the TMDL, this is a global issue which additionally should be addressed by the U.S. EPA and the federal government. We are concerned that the incremental loading from deposition may make the TMDLs goals unattainable. Stormwater agencies have limited control options if they are expected to reduce their loadings by about 50 % but one third of the loading is from atmospheric deposition and not controllable. In effect they will need to remove about 70% of the “controllable” mercury.

8. **Estimate of Storm Water Loading** – We note that the characterization of the amount of mercury in urban runoff described in the report cited in the Amendment (*Joint Stormwater Agency Project to Study Urban Sources of Mercury, PCBs and Organochlorine*, April 2002)

is based on runoff analysis that did not include any highway sites. The Board's estimate of the mercury contribution in urban runoff is almost 2/3 higher than the estimate in this report due to differences in assumption in sediment load and whether the median or mean is the better estimate of central tendency of mercury concentrations in runoff. We believe that future monitoring may result in substantial changes in the estimates of the stormwater runoff contribution to Bay mercury loading. The TMDL document needs to clearly address how substantial changes will be addressed in the assigned allocations.



Delta Diablo Sanitation District

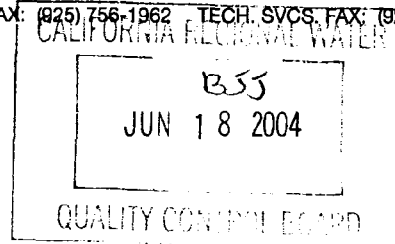
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June 14, 2004

VIA FACSIMILE NO. (510) 622-2460 (hard copy to follow)

Mr. Bruce Wolfe, Executive Officer
Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, CA 94612



**SUBJECT: COMMENTS ON MERCURY IN SAN FRANCISCO BAY TMDL,
PROPOSED BASIN PLAN AMENDMENT AND STAFF REPORT DATED
APRIL 30, 2004**

Dear Mr. Wolfe:

The Delta Diablo Sanitation District's (District) Board and staff appreciate the efforts by you and your staff to develop a Mercury Total Maximum Daily Load (TMDL) and bring forward a Basin Plan amendment and supporting documentation. The District, serving 185,000 residents in East Contra Costa County, believes that the concept of developing a Mercury TMDL in order to meet water quality standards is consistent with its strategic planning and Mission Statement "to safeguard and enhance the environment..." Over the last year, the District and Regional Water Quality Control Board (RWQCB) staff worked together to renew the District's National Pollutant Discharge Elimination System (NPDES) permit. As stated at the December 3, 2004 public hearing where the District's NPDES permit was adopted by the RWQCB, the District was impressed with the cooperation and professionalism experienced during the negotiation process.

Upon review of the April 30, 2004, Mercury in San Francisco Bay TMDL Proposed Basin Plan Amendment and Staff Report, the District has some very serious concerns, including WLA changes from the June 2003 draft TMDL to the April 2004 TMDL. As an Associate member of the Bay Area Clean Water Agencies (BACWA), we fully support the input that BACWA is providing to the TMDL and Basin Plan Amendment process. In addition to BACWA comments, the District feels compelled to raise a couple concerns:

- 1) The District has consistently invested in ways to decrease contaminant loading on the San Francisco Bay Estuary. It has implemented a strict pretreatment program, commenced operations of the largest industrial recycling project in the State of California in 2001, and opened a \$1M household hazardous waste facility in 2003. Our recent NPDES permit term requires us to implement a MRP costing the District's ratepayers the equivalent of a 0.5% rate increase. All of those public ratepayer investments have resulted in fewer pollutants reaching the District's outfall. The proposed Basin Plan Amendment gives no credit for these investments, and, in fact, penalizes the District for improved performance.
- 2) The District negotiated a Mercury mass limit based on permitted design capacity and current performance that became effective with its new permit in February 2004. The

Mr. Bruce Wolfe, Executive Officer

June 14, 2004

COMMENTS ON MERCURY IN SAN FRANCISCO BAY TMDL, PROPOSED BASIN
PLAN AMENDMENT AND STAFF REPORT DATED APRIL 30, 2004

Page 2

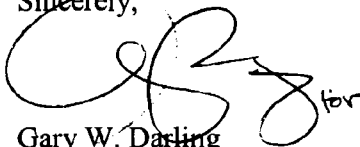
District determined that the adopted permit limit of 0.038 kg/month (0.46 kg/y) could be met without violation during the 5-year permit term.

In addition to explaining how the District's WLA changed from the June 2003 proposed amendment to the April 2004 proposed amendment, the District requests the following changes to the Basin Plan Amendment:

- 1) Establish the POTW WLA that provides recognition for POTWs who have been investing in improvements that are resulting in decreasing Mercury discharges.
 - a. Under the Mercury Sources Control Actions section for Municipal Wastewater in Appendix A (Proposed Basin Plan Amendment), include language similar to the Urban Stormwater Runoff and Guadalupe Watershed sections allowing dischargers to receive credit against their WLA for their efforts to reduce mercury discharges as a result of implementing pollution prevention programs, source control programs, and additional treatment.
 - b. Set the time period for calculating credits so that it is consistent with the time period for collecting data under this TMDL analysis.
 - c. Change the language from the "the Water Board may recognize" to "the Water Board will recognize" efforts taken toward load reduction.
 - d. In cooperation with BACWA, establish a methodology for determining credits. By doing that the RWQCB will provide the certainty the POTWs need in order to justify public dollar investments in Mercury Reduction Programs.
- 2) Consistent with strategies for determining attainment of the load allocation in the Central Valley and Guadalupe Watersheds and the Urban Stormwater Runoff sources, return to the rolling 5-year average for determining POTW attainment to recognize there is seasonal variability in wastewater flows.

Again, as an Associate member of BACWA, we support the comments being offered by BACWA on behalf its members. We thank you for taking our comments into consideration and we look forward to changes that will result in appropriate and beneficial results for the San Francisco Bay Estuary.

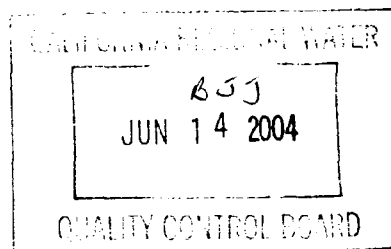
Sincerely,



Gary W. Darling
General Manager/District Engineer

Cc: Donald P. Freitas, Board Chairman
Board of Directors
Jim Kelly, BACWA Chair

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June 8, 2004

Mr. Bill Johnson
Mr. Richard Looker
San Francisco Bay Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

Subject: Comments on *Mercury in San Francisco Bay: Total Maximum Daily Load (TMDL) Proposed Basin Plan Amendment and Staff Report*
Project No. 8602415.001 0201

Dear Gentlemen:

Exponent wishes to submit the attached 2 copies of comments on *Mercury in San Francisco Bay: Total Maximum Daily Load (TMDL) Proposed Basin Plan Amendment and Staff Report* for consideration by the Regional Water Quality Control Board. We request that these comments be made a part of the record for the Board's consideration during the public hearings scheduled for June 16, 2004 and September 15, 2004.

Sincerely,

Gary N. Bigham
Principal

Enclosures (1)

**Exponent's Comments on
Mercury in San Francisco Bay:
Total Maximum Daily Load (TMDL) Proposed Basin Plan
Amendment and Staff Report**

Introduction and Summary of Conclusions

The following comments on *Mercury in San Francisco Bay: Total Maximum Daily Load (TMDL) Proposed Basin Plan Amendment and Staff Report* (Staff Report) (SFBRWQCB 2004) have been prepared by Exponent on behalf of the Santa Clara Valley Water District. The comments are based on our 15 years of experience with investigations of mercury cycling and bioaccumulation at contaminated and uncontaminated freshwater and estuarine sites across the country.

In general, we believe that the San Francisco Regional Water Quality Control Board's (the Board's) sole focus on mercury in sediment overlooks much of the state-of-the-science knowledge regarding the behavior of mercury in the environment, and this oversight renders the conclusions of the analysis invalid. The Staff Report recognizes many of the complications of assessing cycling and bioaccumulation that are unique to mercury, but does not take them into account. As described in detail below, it is well documented that the assumptions that all mercury species are equally available for methylation and that there is a proportional relationship between mercury in sediment and mercury in fish tissue, as the Board has assumed, are incorrect.

The linkage analysis and technical foundation of the Bay TMDL for mercury do not reflect the state of the science. There is no technical basis for assuming that, "If sediment mercury concentrations are reduced by 50%, then fish tissue and bird egg mercury concentrations will be reduced by 50%" (pg. 90, SFBRWQCB 2004). Data from San Francisco Bay do not exhibit a proportional relationship between sediment total mercury and methylmercury. Also, a causative relationship between sediment methylmercury and fish tissue concentrations cannot be argued for food webs where the lower trophic levels are dominated by plankton. In this case, dissolved methylmercury is the more important parameter affecting bioaccumulation. No attempt to reconcile bioaccumulative pathways was made in the TMDL presented in the Staff Report. The Bay TMDL for mercury also incorrectly assumes that, "Mercury from all sources is similarly available to be converted to methylmercury and taken up into the food web" (pg. S-2, SFBRWQCB 2004). This is an overly simplified assumption that neglects that mercuric sulfide (HgS) contributed from abandoned mercury mines has a lower methylation potential than adsorbed inorganic mercury or elemental mercury from other sources.

In addition, the proposed TMDL does not account for the relative bioavailability of mercury from different sources, although it acknowledges, "Mercury newly deposited in the environment is more readily methylated than existing mercury already in the system (Benoit et al. 2003).

[Furthermore,] this suggests that, although most of the mercury in San Francisco Bay results from historical sources (Dorrance 2002; USGS 2000), recent mercury additions may be proportionally more responsible for human and wildlife mercury exposure” (USGS 2003) (pg. 51–52).

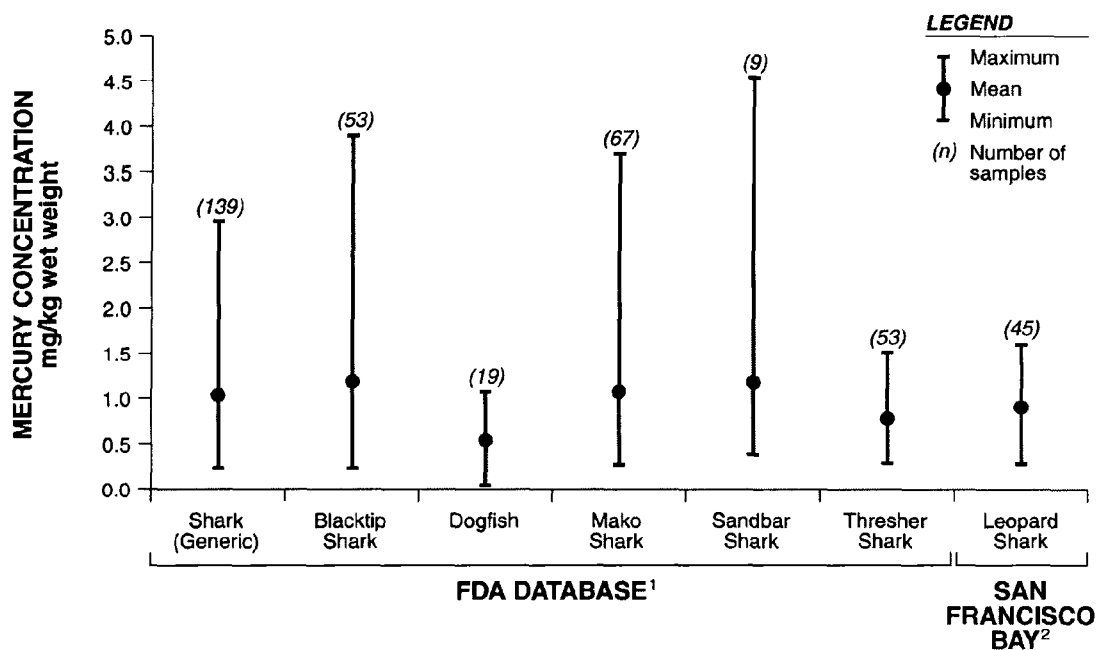
Finally, the proposed San Francisco Bay TMDL for mercury does not distinguish between dissolved and sediment-bound mercury in its load allocations. Instead, “The proposed allocations are based on the assumption that the mercury from all sources is equally available to be converted to methylmercury and incorporated within the food web” (pg. 51). This assumption is inconsistent with the known methylation process, whereby dissolved mercury is first incorporated into the cells of sulfate-reducing bacteria, either through passive (Benoit et al. 1999a,b) or facilitated (Golding et al. 2002) mechanisms.

Mercury Concentrations in Leopard Shark are Probably Not Related to Mercury in San Francisco Bay Sediment

Fish consumption is one of the three lines of evidence of impairment described in the Problem Statement section of the Staff Report. The California Office of Environmental Health Hazard Assessment (COEHHA) has issued an interim advisory to limit consumption of certain fish from San Francisco Bay (COEHHA 2001). The interim advisory applies primarily to sturgeon and striped bass and was imposed “because of elevated levels of mercury, PCBs, and other chemicals.” The average mercury concentration in sturgeon only slightly exceeds the U.S. Environmental Protection Agency (EPA) water quality criterion for methylmercury in water, which is 0.3 mg/kg wet weight in fish tissue, as shown in Figure 2.2 of the Staff Report. The average mercury concentration in striped bass is less than 0.4 mg/kg. The highest tissue mercury concentrations in Figure 2.2 are reported for leopard shark, ranging as high as 1.6 mg/kg and with a mean of 0.9 mg/kg.

It is unclear whether mercury concentrations in any of these species are truly “elevated” because of mercury in sediment. The white sturgeon and leopard shark are relatively long-lived species that naturally exhibit higher levels of mercury bioaccumulation. Similarly, the leopard shark and striped bass are piscivorous predators, near the top of the food web, that naturally exhibit the highest levels of biomagnification.

Data for mercury in shark presented in Figure 1 show that levels in San Francisco Bay leopard shark are not significantly different from concentrations in other shark species measured by the U.S. Food and Drug Administration (FDA). The FDA’s sampling locations are not listed in the database (<http://vm.cfsan.fda.gov/~frf/seamehg2.htm>); however, the locations are believed to be representative of uncontaminated areas where shark are captured commercially. FDA data for mercury in sturgeon and striped bass are not available; however, comparison of data from San Francisco Bay with other uncontaminated locations may show that, like the leopard shark, the concentrations at uncontaminated sites and San Francisco Bay are similar.



¹ Data from FDA March 2004. <http://vm.cfsan.fda.gov/~frf/seamehg2.html>

² Data from San Francisco Bay Estuary Institute. <http://www.sfei.org/rmp/data/rmpfishissue.htm>

Figure 1. Comparison of mercury concentrations in San Francisco Bay leopard shark with other sharks tested by FDA

Relevance to San Francisco Bay

This is a critical issue that should have been evaluated in the Staff Report. Because tissue concentrations similar to uncontaminated sites indicate that there is no unusual pathway for mercury transport from the sediment, and that the tissue concentrations are “naturally occurring.” Under these circumstances, reduction of sediment mercury concentrations will not lower tissue concentrations.

The Linkage Between Total Mercury in Sediment and Methylmercury in Fish is Inadequate

The Staff Report for mercury bases its load allocations on the inappropriate assumption that total mercury measured in benthic or suspended sediment and methylmercury measured in fish tissue in the Bay are proportional.

Scientific Background

The concentration of mercury in fish tissue depends on the nature and efficiency of a number of biogeochemical processes that vary among and/or within estuarine ecosystems:

1. The first governing process is the solubilization of sediment-bound mercury into the porewater. As demonstrated by Bloom et al. (2003), the relative degree of mercury solubility is dependent on its chemical form, with sorbed or organo-chelated compounds exhibiting higher solubility than mercuric sulfide. Although solubility is also enhanced by the complexation of mercury with dissolved organic matter (Ravichandran et al. 1998), it is diminished by the sequestration by particulate-bound organic matter (Hammerschmidt and Fitzgerald 2004), re-precipitation as sulfides under fluctuating redox conditions, or adsorption onto iron oxides (Bonnissel-Gissinger et al. 1999; Caille et al. 2003; Gagnon et al., 1996, 1997) or clays (Nguyen et al. 1994).
2. A second governing process is the transformation of dissolved mercury to methylmercury. Net methylmercury production, which generally occurs within the top few centimeters of anaerobic sediment (Compeau and Bartha 1985), is controlled primarily by the activity of sulfate-reducing bacteria. Bacterial activity is dependent on temperature (Matilainen et al. 1991), pH and sulfate/sulfide concentrations in the overlying water (Gilmour et al. 1998), and dissolved oxygen (Gill et al. 1999). Methylmercury production is also dependent on the concentration of certain aqueous species of mercury, although the exact mercury forms are a topic of current scientific research. Benoit et al. (1999a,b) provided evidence that neutral mercury sulfide species are important, presumably due to their ability to passively diffuse into the cell membrane of sulfate-reducing bacteria. Golding et al. (2002), by contrast, observed enhanced bacterial uptake in the presence of weak organic acids, indicating a facilitated transport mechanism.
3. Finally, the degree of mercury bioaccumulation depends on the structure of individual food webs (Morel et al. 1998). Entry into the food web can occur via two pathways: 1) assimilation of dissolved species, or 2) ingestion of sediment-bound forms. An example of the former is the direct uptake of dissolved methylmercury in the water column by phytoplankton (Watras et al. 1998). Examples of the latter include the direct ingestion of sediment-bound methylmercury via detritivores and/or sediment-dwelling organisms (Parkman and Meili 1993; Nuutinen and Kukkonen 1998), or the ingestion of mercury bound to suspended particulate matter by filter-feeding zooplankton or grazing organisms, detritivores, or particle-degrading bacteria (Gilmour and Henry 1991; Plourde et al. 1997; Tremblay et al. 1998). Depending on the nature of the food web, tissue concentrations in a particular fish species may be predominantly a function of the concentrations of either dissolved or particulate-bound methylmercury (Becker and Bigham 1995).

Inadequate Linkage Between Total Mercury and Methylmercury in Sediment

The authors of the Staff Report acknowledge, “Factors relating to mercury methylation and accumulation within the food web are complex and not fully understood.” However, “In the absence of additional information, reductions in mercury loads are assumed, for purposes of this (TMDL) report, to result in proportional reductions in fish tissue residues” (pg. 48, SFBRWQCB 2004). The Staff Report specifically assumes that a 50% reduction in median sediment mercury concentrations will produce a calculated 40% reduction in fish-tissue mercury concentration, which would be required to protect the Bay’s beneficial use of sport fishing. (Note that this reduction is also assumed to be protective of wildlife and rare and endangered species.) The justification for this assertion is the following: “At any particular location, the mercury methylation rate in surface sediment is probably roughly proportional to mercury concentrations in the sediment when sediment concentrations are less than 1 ppm” (pg. 47, SFBRWQCB 2004). Although the report acknowledges, “The structure of the food web (what eats what) determines the efficiency of transfer among organisms” (pg. 48, SFBRWQCB 2004), the proposed TMDL report does not attempt to link impaired fish species to food-web pathways.

Due to the numerous variables that contribute to the transformation of mercury into methylmercury, it is not surprising that the Board’s citation, purported to demonstrate a proportional relationship between total sediment mercury and sediment methylmercury below a sediment mercury concentration of 1 ppm, does not provide the correlation attributed to it. The U.S. Geological Survey (USGS) study of Krabbenhoft et al. (2003) consisted of sampling 106 sites from 21 basins across the United States for total mercury and methylmercury and looking for trends in the data. The apparent relationship between basin-averaged total and methylmercury concentrations is shown on Figure 2a. Although there is a positive correlation indicating that, “At high total mercury levels little additional methylmercury is produced with additional total mercury” (Krabbenhoft et al. 2003), the data below 1 ppm (equivalent to 1 mg/kg) display a weak, negative correlation (Figure 2b).

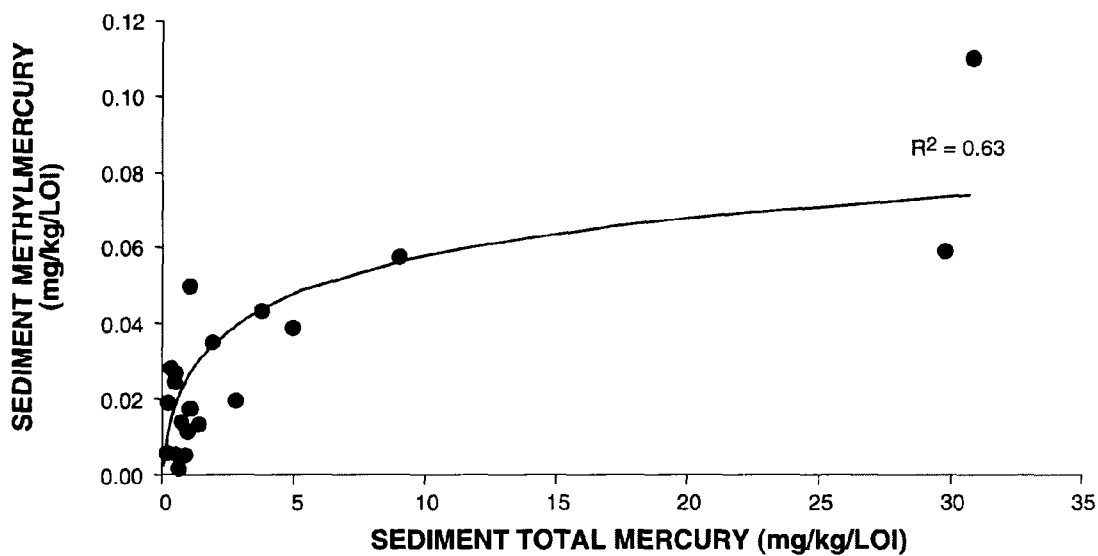


Figure 2a. Average normalized (to loss on ignition [LOI]) sediment methylmercury vs. total mercury for the 21 basins studied by Krabbenhoft et al. (2003)

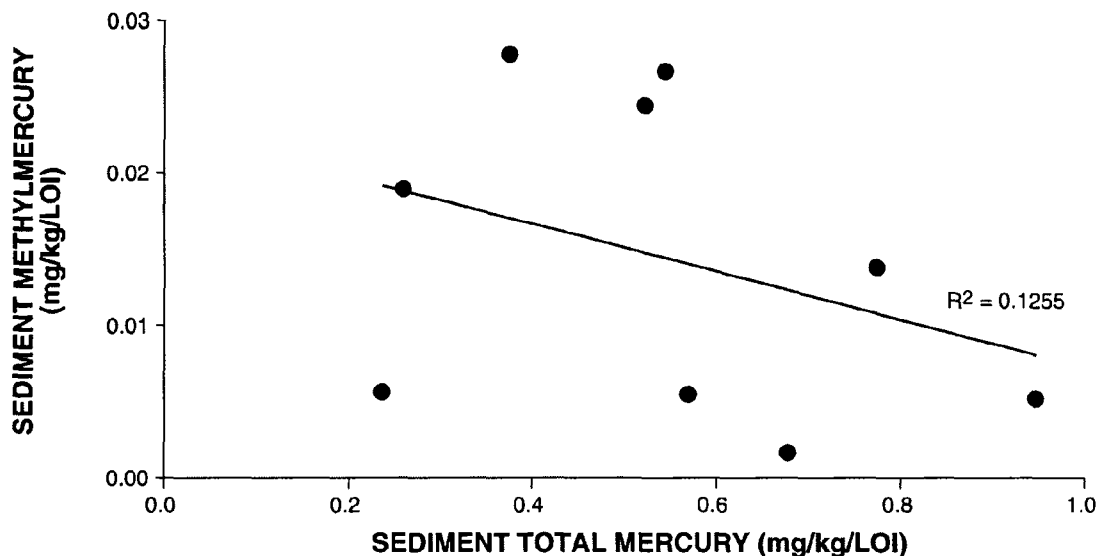


Figure 2b. Average normalized (to LOI) sediment methylmercury vs. total mercury for the 21 basins studied by Krabbenhoft et al. (2003), for total mercury less than 1 mg/kg/LOI

There is also a weak correlation between total sediment mercury and methylmercury concentrations evident in data for the San Francisco Bay estuary (Figure 3). Although there are likely several causes for the scatter in the data, one identified explanation is the difference in chemical environments represented by the many channels and subtidal salt marshes in the Bay. For example, Heim et al. (2002) found an improved correlation ($R^2 = 0.52$) when marsh habitats

were considered independently. Also, Marvin-DiPasquale et al. (2003) found that marsh and open-water sediment samples from San Pablo Bay had similar total mercury concentrations (0.3–0.6 ppm) and isotopic signatures indicative of historical mining activities; however, the marsh sample had an in-situ methylmercury concentration of 5.4 ppb (relative to <0.7 ppb for open-water sites), and had measurable microbial methylmercury production. A link between sediment methylmercury and fringing wetlands is consistent with the conclusion of Krabbenhoft et al. (2003) that wetland density is the most important basin-scale factor controlling methylmercury production.

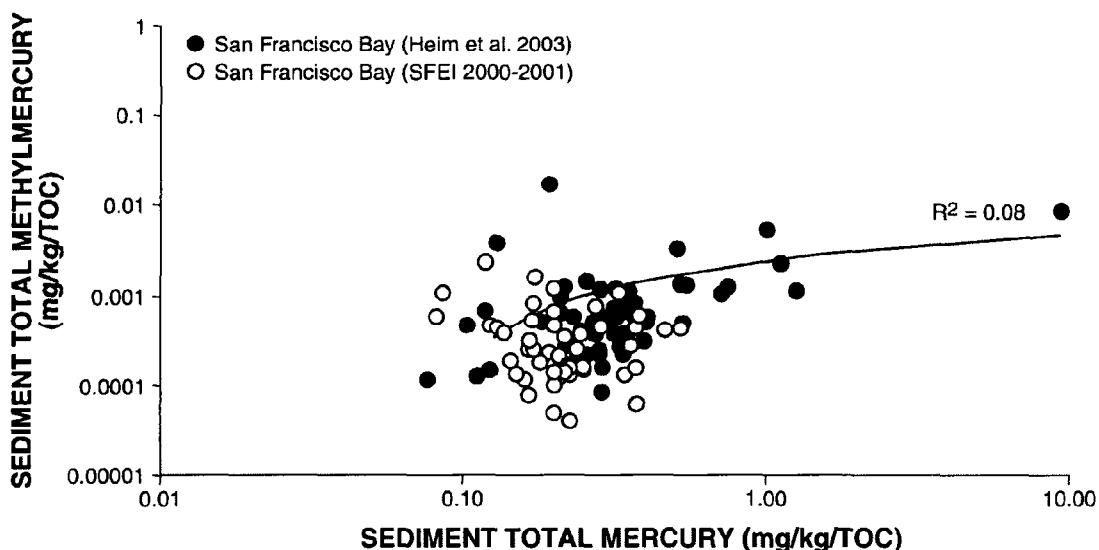


Figure 3. Relationship between methylmercury and total mercury in San Francisco Bay sediment (normalized by total organic carbon [TOC])

Inadequate Linkage Between Total Mercury in Sediment and Fish Tissue

Given the lack of correlation between total sediment mercury and methylmercury, it is not surprising that the combined USGS data of Krabbenhoft et al. (2003) and Brumbaugh et al. (2001) do not exhibit a correlation between total sediment mercury concentrations and fish tissue (Figure 4). In fact, Brumbaugh et al. (2001) concluded that the best predictor of mercury concentrations in largemouth bass is dissolved methylmercury.

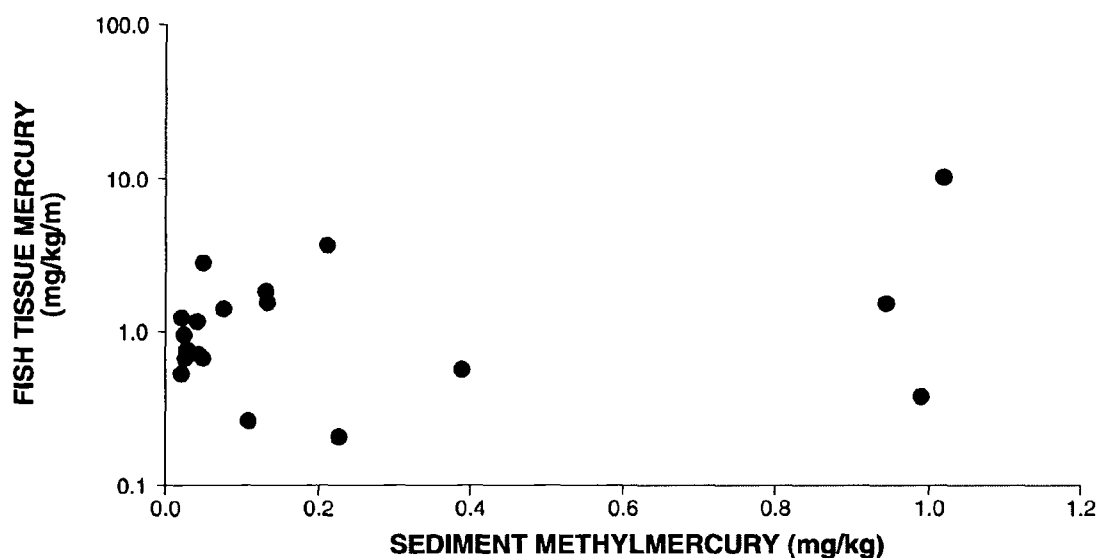


Figure 4. Average normalized (to length) fish-tissue mercury vs. sediment methylmercury for the 21 basin studies by Krabbenhoft et al. (2003)

Evidence for the importance of the dissolved food-web pathway is provided on Figure 5. Mercury concentrations in sunfish from Reality Lake (Oak Ridge, Tennessee), a site highly contaminated by mercury in the sediment, were monitored for the period 1999–2000. Following the elimination of the primary source of dissolved mercury to the lake in 1998, there was a dramatic decrease in fish-tissue mercury concentrations.

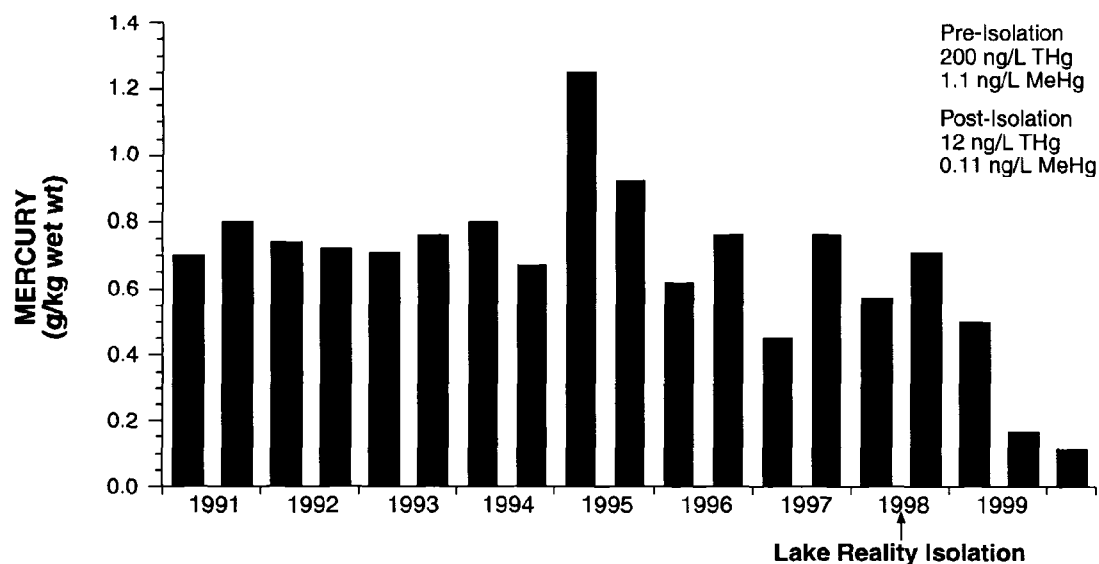


Figure 5. Mercury in Reality Lake sunfish decreased over the first growing season, when a bypass eliminated inputs of dissolved mercury

Direct correlation between dissolved mercury loads and fish tissue is also evident from the data on Figure 6 for Onondaga Lake, New York.

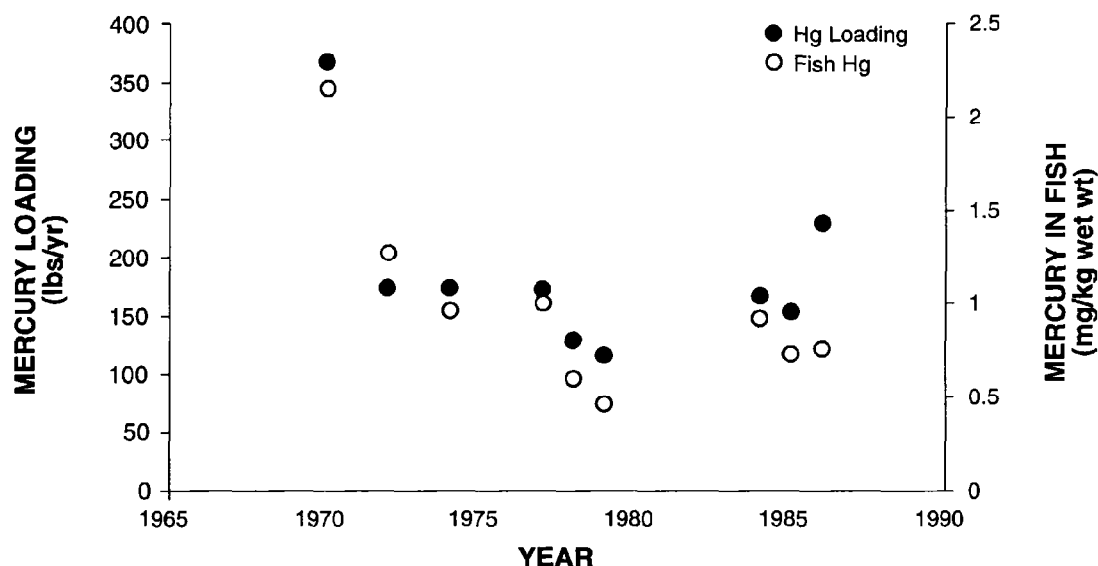


Figure 6. Mercury loading and mercury in fish tissue at Onondaga Lake, New York

Finally, the Central Valley Regional Water Quality Control Board (CVRWQCB 2004) used the following scientific evidence in developing their linkage analysis for the Cache Creek, Bear Creek, and Harley Gulch TMDL for mercury (pg. 73):

“The relationships between aqueous and biotic methylmercury concentrations were investigated in an intensive 20-month study in the Cache Creek watershed (Slotton et al. 2002). Statistically significant positive log/log relationships were observed between waterborne mercury and methylmercury tissue concentrations in bottom dwelling invertebrates when all locations were grouped together. Similar relationships were noted between waterborne mercury and methylmercury in small fish... The conclusion that biotic tissue concentrations correlate best with raw waterborne methylmercury is consistent with the observations of others (Foe et al. 2002; Brumbaugh et al. 2001).”

Accordingly, considering the complexities involved in mercury bioaccumulation, the CVRWQCB has not adopted numeric criteria for sediment: “Concentrations of mercury or methylmercury in sediment are not as closely related to measures of impairment, as are measures of methylmercury in water or fish tissue” (pg. 17, CVRWQCB 2004). Studies cited in their linkage analysis show that the greatest methylmercury production rates occur in seasonally flooded wetlands (Heim et al. 2002), and the greatest linkage to fish-tissue concentrations is dissolved methylmercury concentrations (Slotton et al. 2002). Consequently, the CVRWQCB is proposing numeric targets for dissolved methylmercury and a phased implementation plan that

will attempt to reduce mercury loads to areas of the watershed, such as wetlands, where dissolved methylmercury is generated.

Adsorbed Inorganic Mercury is Not the Same as Mercuric Sulfide with Respect to Methylation Potential

Mercury Forms in San Francisco Bay

The largest external sources of mercury to San Francisco Bay are estimated by the Staff Report to be the Central Valley watershed, urban stormwater runoff, and the Guadalupe River watershed (SFBRWQCB 2004). Mercury from the former two sources is best characterized as inorganic mercury adsorbed to suspended particulate matter in drainage from abandoned mercury mines such as the New Almaden in the Guadalupe River watershed. The reasoning is that cinnabar (HgS) was the predominant form mined in the Coastal Ranges, whereas elemental mercury (Hg⁰) was the chemical form used to extract gold ore along the front range of the Sierra Nevada. Evidence for this difference in chemical form is provided by Bloom (2001), who sampled sediment downstream of three inactive mercury-mining districts in the Cache Creek watershed and a gold mining district in the Consumnes River watershed of the Sierra Nevada. The study found that HgS constituted 98% of the solid-phase fraction of mercury in the former, but organically complexed forms were predominant in the latter.

It is acknowledged that mercuric sulfide (HgS) originating from abandoned mercury mines may be converted to more labile forms over time (Bloom et al. 2003) and distance from the source (Bloom 2001); however, the conversion is likely incomplete. For example, Hines et al. (2001) reported that cinnabar was the predominant form of mercury in the Gulf of Trieste, an aquatic environment that receives drainage from abandoned mercury mines.

Methylation Potential of Mercury Mine Drainage

Figure 7 compares estimated methylation rates and total porewater mercury concentrations from the Gulf of Trieste (Hines et al. 2001) to Long Island Sound (Hammerschmidt and Fitzgerald 2004). Whereas mercury in the Gulf of Trieste is predominantly characterized by cinnabar, mercury in Long Island Sound is organically complexed. As shown on the figure, methylation rates and total dissolved mercury concentrations are lower for the Gulf of Trieste, consistent with the lower methylation rates measured for cinnabar in batch incubation experiments (Bloom et al. 2003). The USGS study of Cache Creek (Domagalski et al. 2004) concluded, "Solid-phase cinnabar-containing minerals do not represent a major methylation source" (pg. 10).

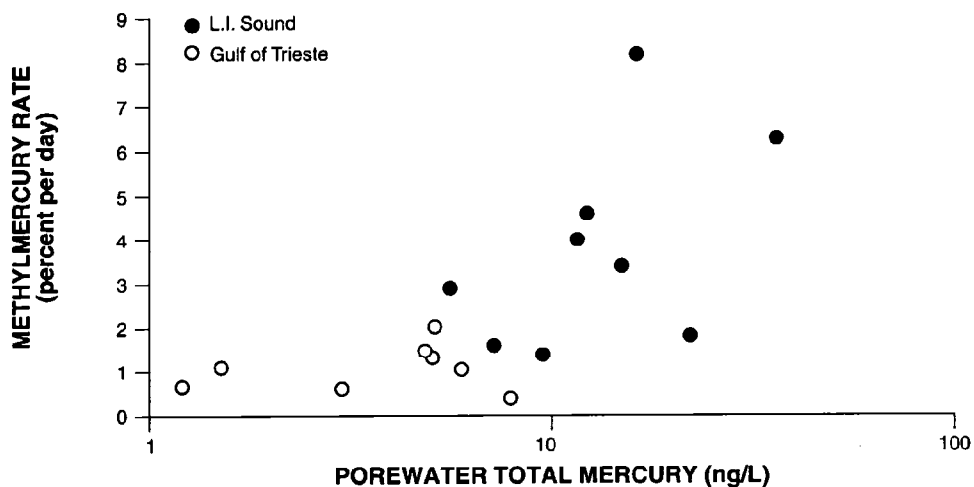


Figure 7. Relationship between mercury methylation rate and porewater mercury concentration

Implications of SFBRWQCB Approach

The lower methylation potential of cinnabar is consistent with the lower methylation potential measured for Coastal Range relative to Sierran sediment (Heim et al. 2002). This relationship is important because it implies that mercury from all sources (to San Francisco Bay) is not similarly available to be converted to methylmercury. Figure 8 compares dissolved porewater methylmercury from the two sites to the total sediment mercury concentration numeric target of 0.2 mg/kg. Assuming that the concentrations presented on the figure are consistent with the solubility and degree of mercury transformation of organic versus inorganic sulfide forms, a reduction in sediment mercury concentrations from cinnabar-dominated areas is not predicted to achieve a reduction in dissolved methylmercury. This consideration is not included in the load allocation for the Guadalupe River.

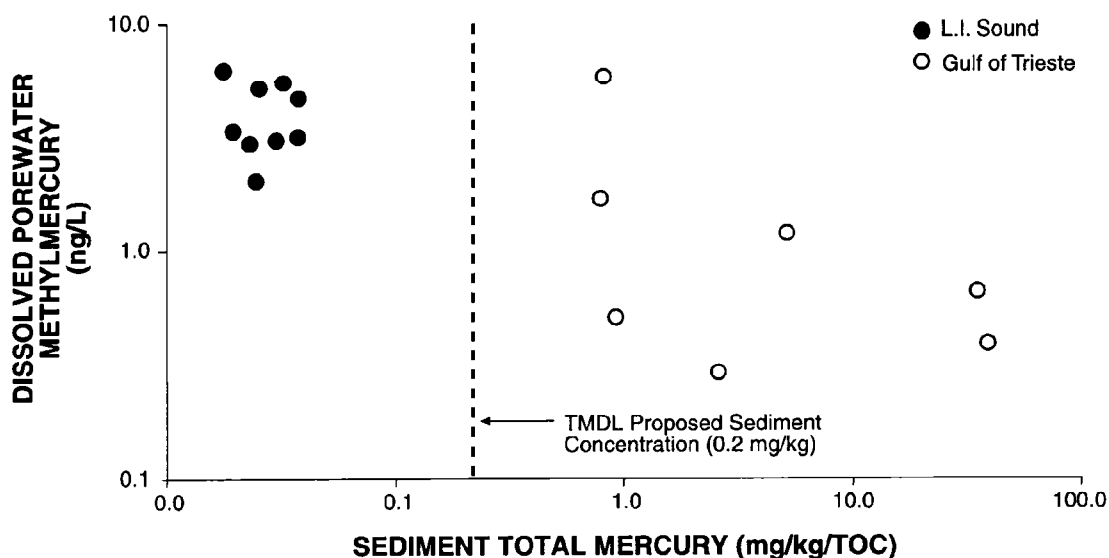


Figure 8. Relationship between total dissolved porewater methylmercury and total mercury in sediment (normalized by TOC)

“New” Mercury from Point Sources and Tributaries is a More Significant Source for Methylation than “Old” Mercury

“New” Versus “Old” Mercury

The relative bioavailability of “new” versus “old” mercury can be deduced by introducing stable isotopes of mercury (e.g., ^{202}Hg) into a water body. The introduced mercury can then be distinguished from ambient mercury using mass spectrometry. This technique was used in four mesocosm experiments in the Florida Everglades (USGS 2003). The result of spiking the enclosures with different doses of mercury revealed the following.

1. There is a positive and linear relation between mercury added and the production of methylmercury.
2. There is an exceptionally close tie between mercury added and bioaccumulation of the added mercury in fish.
3. There is an “aging effect” for new mercury added to the ecosystem, such that more recent doses of mercury isotopes are more likely to be bioaccumulated than older mercury.

Relevance to San Francisco Bay

Mesocosm experimental results are important because they imply that “aged” particle-bound mercury introduced into the San Francisco Bay estuary may be a less important source of methylmercury than dissolved forms. This conclusion is consistent with measured mercury concentrations in sunfish from Reality Lake, a site highly contaminated by mercury in the sediment (Figure 5). Following elimination of the primary source of dissolved mercury to the lake in 1998, there was a dramatic decrease in fish-tissue mercury concentrations.

Dissolved Mercury Loads are a More Significant Source for Methylation than Sediment-Bound Mercury Loads

Dissolved Versus Sediment-Bound Mercury

The methylation potential of various dissolved and sediment-bound mercury loads was investigated by Bloom (2001) using sediment from Cache Creek. First, various dissolved and sediment-bound mercury forms were spiked to methylating sediment. Next, the slurries were incubated for one week, and the total methylmercury concentrations were measured. It was found that the smallest net change in methylation occurred for the mine tailings spike. It was also found that mercury adsorbed to kaolin was half as bioavailable as the dissolved mercury spikes.

Relevance to San Francisco Bay

Some dischargers introduce mercury into San Francisco Bay that is predominantly dissolved (Hsu and Sedlak 2003). By not considering the relatively high methylation potential of dissolved mercury, the assumption that the mercury from all sources is equally available implies that some waste-load allocations will be overestimated. Consequently, if the proposed San Francisco Bay TMDL for mercury is implemented, the most bioavailable forms of mercury may continue to be released into the Bay.

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Fairfield-Suisun Sewer District

Richard F. Luthy, Jr.
General Manager/District Engineer

June 14, 2004

RW-100.10.10/04

Mr. Richard Looker
Mr. Bill Johnson
San Francisco Bay Regional
Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

Reference: Comments on *Mercury in San Francisco Bay – Total Maximum Daily Load Proposed Basin Plan Amendment and Staff Report*, April 30, 2004

Dear Mr. Looker and Mr. Johnson:

The Fairfield-Suisun Sewer District (District) appreciates the opportunity to comment on the above referenced document and wishes to acknowledge the substantial efforts of both you and other Regional Board staff in drafting this complex and comprehensive document.

The District provides wastewater collection and treatment and stormwater pollution prevention services to approximately 131,000 customers in central Solano County. Our wastewater treatment facility treats wastewater to near drinking water standards and discharges the treated effluent to either the environmentally sensitive Suisun Marsh or for reuse by agriculture, landscape irrigation, and/or industrial cooling. As a Phase I Stormwater Permittee, the District has been responsible for control of stormwater pollution to the maximum extent practicable in our service area for nearly 12 years.

Because of potentially grave impacts to the District's wastewater and stormwater NPDES permits and to projected growth in the District's service area, the District provides the following comments to aid Regional Board staff in development of an environmentally sound TMDL that is equally protective of the economic and social needs of the communities the Regional Board serves:

- 1) The District is strongly supportive of comments submitted by the City of San Jose and the Bay Area Stormwater Management Agencies Association (BASMAA).



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2) Relative to impacts on the District's wastewater NPDES permit, the District provides the following:

- a. The treatment plant's mercury load allocation was reduced by greater than a factor of 3 between the June 6, 2003, draft report and the April 30, 2004, report (from 0.45 kg/yr to 0.14 kg/yr – at current design flow, concentration limits are reduced from 19 ng/l to 6 ng/l). In reviewing the loading allocation tables, it appears that the treatment plants with the best performance have been the most penalized by the revised allocations. This violates the Board staff's stated intent to not penalize the best performers to protect the poorer performers and is counter to common sense (What incentive is there to perform well when excellent performance is penalized by reducing allocations?).

Action – The best performing Bay area wastewater treatment plants should not be penalized for their excellent performance.

- b. In the next 5 years, the District will expand its treatment plant's dry weather flow capacity by 35% (from 17.5 mgd to 23.7 mgd). The reduced allocation in the April 2004 report results in a 4 ng/l concentration limit at the revised design flow (23.7 mgd). Current plant performance is over 3 ng/l. In a wet year, such as the 1998 *El Nino* year, the treatment plant will certainly violate this load allocation; therefore, this allocation is a de facto growth cap for the cities of Fairfield and Suisun City and a critical national defense facility, Travis Air Force Base.

Action – Allocations must be set at levels that do not inhibit planned growth within Bay area communities.

- c. The June 2003 mercury report proposed a compliance determination averaging period of five years. This longer averaging period would tend to smooth out the inherent annual variability caused by wet and dry years. The April 2004 mercury report revised the compliance determination averaging period to one year. This change will result in greater probability of violating both individual and group allocations in a wet year.

Action – Regional Board staff should set the compliance determination averaging period as long as legally possible to avoid unintended violations of loading allocations.

- d. Based on loading values from the April 2004 mercury report, wastewater treatment plants constitute about 1% of the mercury loading to the San Francisco Estuary. In the June 2003 mercury report, the wastewater treatment plant allocation was set at 17 kg/yr. In the April 2004 mercury report, the wastewater treatment plant allocation was set at 14 kg/yr, an unexplained 18% reduction. The change appears intended to hold wastewater treatment plants to current performance and, as a consequence, acts as a growth cap for growing communities in the Bay area, violating specific terms of the Clean Water Act that require allowance for reasonable municipal growth when setting limits.

Action – The total allocation for all wastewater treatment plants should be set at a minimum of 17 kg/year to insure adequate room for planned municipal growth.

- 3) The District provides the following comment relative to impacts on our stormwater NPDES permit. The April 2004 mercury report requires a 51% reduction in mercury loads from urban sources. The report states that these reductions can be achieved through implementation of pollution prevention activities, elimination of highly enriched waste streams (i.e., mine drainage and waste), treatment of runoff through vegetated strips, and, potentially, treatment of stormwater through diversion to wastewater treatment plants. While each of these activities may reduce mercury loads to varying degrees, there is no assurance, in fact it is highly unlikely, that these activities will result in the dramatically reduced mercury loads to the San Francisco Estuary contemplated in the report.

Action – The District requests that Board staff develop and include in the final report an implementation plan that formalizes periodic loading status/attainability reviews coupled with adaptive management to insure the loading reduction estimates included in this document are reasonable and real and that they do not place proactive NPDES permit holders in jeopardy of permit violations.

District staff looks forward to working with you to implement a successful mercury TMDL that fully supports the needs of our estuary and the citizens who live in the surrounding communities.

Please contact me by e-mail at lbahr@fssd.com or by telephone at (707) 429-8930.

Sincerely,



Larry Bahr
Senior Environmental Scientist

/cb

June 11, 2004

Bill Johnson

San Francisco Bay Regional Water Quality Control Board

1515 Clay Street, Suite 1400

Oakland, CA 94612

by e-mail: bjj@rb2.swrcb.ca.gov

Subject: TMDL for Mercury in San Francisco Bay

Dear Mr. Johnson:

In reviewing the TMDL Project Report it appears that the document does not fully address natural background levels of mercury nor unavoidable mercury inputs such as aerial deposition.

The TMDL is predicated on a number of assumptions concerning sources including 0.26 ppm for sediment from the Central Valley, 0.38 ppm for Hg in sediment carried by urban stormwater, and 0.06 ppm carried by non-urban runoff. The TMDL goal is 0.2 for sediment.

However, a review of typical "natural" (i.e., uncontaminated) soil concentrations for mercury indicates that some soils in the state are significantly above the goals. These include soils around Sacramento which potentially may be developed and contribute sediment which could be substantially above the goals or even above present loading. Thus, the loading in some locations may be more dependent on the particular soils being eroded than on mercury contamination.

In other words, by not considering the "natural" component of the mercury loading which may be dominant in some locations, we could be establishing up goals which cannot be attained. Natural erosion or soil dust on roadways may exceed the goals of 0.2 ppm.

The core taken from San Pablo Bay (Fig 4.2) seems to show a possibly "natural" concentration of Hg ranging from 0.3 to 0.4 ppm located in a depositional stratum below the spike from hydraulic gold mining. Grizzly Bay background is around 0.2 but this may be indicative of different inputs. Also, the Tomales Bay "reference" core showing a 0.0 to 0.2 range is, of course, from a different soil type and may not be an appropriate reference.

A preferential approach may be to somehow extract out the "natural" mercury from the source and control requirements so that LAs and WLAs only address the added (human induced) mercury.

A similar issue concerns mercury which is atmospherically deposited. The TMDL estimates that this could represent 30% of the loading. It seems that these two burdens – natural mercury plus atmospherically deposited mercury - could present a burden that could prevent urban agencies from ever attaining the sediment goals regardless of the pollution prevention-type controls they implemented.

Thank you for considering these comments.

S/

Fred Krieger
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Berkeley CA 94705

[E:MAIL VERSION]
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June 11, 2004

BY FACSIMILE, WITH E:MAIL VERSION SENT SEPARATELY

Bill Johnson and Richard Looker
Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street
Oakland, CA 94612

Re: Comments of the City of Sunnyvale On the Proposed Basin Plan
Amendment Implementing the TMDL for Mercury for San
Francisco Bay and the Accompanying Report Entitled: "Mercury in
San Francisco Bay; Total Maximum Daily Load (TMDL): Proposed
Basin Plan Amendment and Staff Report," dated April 30, 2004.

Dear Mr. Johnson and Mr. Looker:

This letter is written on behalf of the City of Sunnyvale, the holder of NPDES
Permit No. CA 00037621, and supplements comments sent under separate cover by
Marvin A. Rose, Director of Public Works for the City of Sunnyvale.

Sunnyvale acknowledges the extensive efforts that the Regional Board staff have
made in attempting to establish a TMDL for mercury for San Francisco Bay. However,
Sunnyvale believes that there are a number of practical and legal problems to be resolved
before the TMDL should be established. The following comments indicate our concerns:

**1. The Individual Wasteload Allocations (WLAs) To Sunnyvale And
Possibly Other Municipal POTWs Leave No Room For Inevitable
Population Growth.**

As more fully discussed in Mr. Rose's comment letter, the individual WLA for
Sunnyvale caps its mercury discharge at its current level (.08 kg/yr), with no allocation

for future growth. As also discussed in that letter, Sunnyvale anticipates a population growth rate approaching 14% by the year 2025. This population growth, together with hoped-for improvements in the business climate in Silicon Valley, are expected to result in a proportional increase in its wastewater influent. This increase will be accompanied by a proportional increase in both influent and effluent mass mercury loadings. There is nothing in the record to substantiate the claim by staff that this growth can be accommodated by any practicable means.

2. The Assumption That Sunnyvale Can Offset Growth Through Additional Source Control, Plant Improvements, Pollution Reduction or Reclamation is Unfounded.

As Mr. Rose's letter points out, there is no practicable way to improve on Sunnyvale's already stellar performance in pollution prevention and source control for mercury, and the only available opportunity for further water reclamation would accommodate a scant one MGD (eliminating only 5.5 grams/yr of mercury) at a cost of \$20 million. There are no other practicable means of reducing mercury loads to accommodate future growth except a moratorium on development, including new housing. Despite the severe implications of this result, the TMDL Report does not even discuss the problems it would create. Sunnyvale cannot speak for other POTW operators affected by the new wasteload allocations, but it submits that similar factors may be present in their situations, particularly among those POTWs with advanced treatment systems. It would be extremely reckless, arbitrary and capricious for the Regional Board to adopt the proposed Basin Plan Amendment without taking into account the obvious need to accommodate future growth over the life of the projected attainment period.

3. The Assumption That Municipalities May Obtain Offsets From Other Mercury Sources Is Unfounded.

The TMDL Report hypothesizes that POTWs that need to grow may obtain offsets from cleaning up other sources of mercury, but this hypothesis is nowhere supported by the record. The TMDL Report admits that "no such [offset] program currently exists."¹ There is no discussion of the enormous problems such a program would face, including: dealing with the CERCLA liability issues arising out of the court's decision in the Penn Mine case; deciding which ratio of offsets to use when allowing growth-induced mercury discharges; persuading the federal EPA to authorize the use of "offsets" when the sources of the "offsets" (i.e. bay margin sites) are not even included in the TMDL; and overcoming the resistance of environmental groups, who traditionally have objected strongly to trading programs on the grounds that they allow pollution to be concentrated into the hands of those who can afford to pay for offsets, with attendant adverse local effects.

¹ TMDL Report, p. 83.

Likewise, the TMDL Report's suggestion that some mercury-discharging "agencies" might reduce their loads, allowing credits for other sources, is unfounded.² There is no discussion in the TMDL Report dealing with the multitude of problems that such a concept would face before it could result in a viable means for POTWs to obtain offsets for growth-induced mercury increases: What are the incentives that would be needed to persuade a POTW to reduce its mercury discharge below its lawful allocation? Assuming any such reduction were to occur, how could one prevent price-gouging by the "owner" of the offsets who would have the growth-starved municipalities at its mercy? Who would administer such a program? How could an "agency" be induced to part with any mercury "credit" it produced, rather than keep it for future use to meet its own anticipated future needs? How can the Regional Board be expected to implement such a program, when the federal EPA has tried repeatedly to do so without success?

It would be unreasonable, arbitrary and capricious for the Regional Board to rely upon a hypothetical future offset trading program to meet the growth needs of the municipalities.

4. If The Regional Board Establishes Individual Wasteload Allocations For The Municipal POTWs, It Must Consider The Impact Of Federal NPDES Regulations, Which May Require Those Wasteload Allocations To Be Incorporated As Mass Limits, Leading To Semi-Permanent Caps On Mercury Discharges Extending Beyond The Year 2025.

Although the authors of the TMDL Report seem to be aware that federal law requires that NPDES permits issued subsequent to the establishment of a TMDL must contain water quality based effluent limitations (WQBELs) that are consistent with wasteload allocations in the TMDL,³ the Proposed Basin Plan Amendment naively states that the "wasteload allocations for individual wastewater dischargers" are only to serve as one of part of a dual "trigger" mechanism, the other part being the concentration "triggers" of 11 nanograms for advanced treatment plants and 21 nanograms for secondary plants, suggesting that they will not be incorporated into NPDES permits as enforceable WQBELs.⁴ However, the record shows clearly that the Regional Board is proposing to create both a bay-wide wasteload allocation as well as individual wasteload

² Ibid.

³ See TMDL Report, p. 76. The authors state that one facet of the implementation plan would be to: "[c]omply with water quality based effluent limitations, to be elaborated through the permit, that are consistent with the assumptions and requirements of the wasteload allocation." (emphasis added)

⁴ Proposed Basin Plan Amendment, p. A-11.

allocations for the POTWs, although it is proposing to treat only the bay-wide allocation as having validity under federal law for NPDES purposes.⁵

The TMDL Report contains no analysis of the potential impact of the NPDES permitting regulations (40 C.F.R. 130.2(h) and 40 C.F.R. 122.44(d)), which state that the permit conditions must be consistent with “any” available wasteload allocations.⁶ If the Regional Board contends otherwise, it should explain on the record the legal rationale for avoiding the application of these regulations once the individual wasteload allocations are established. Absent a sound legal justification for assuming that language in a Basin Plan amendment stating that the wasteload allocations are to be treated only as “triggers,” we are concerned that the Regional Board will subsequently be compelled to impose the wasteload allocation for Sunnyvale as a mass mercury limit in the Sunnyvale NPDES permit. Failure to resolve this issue before adoption of the proposed Basin Plan Amendment would subject Sunnyvale and other POTWs to unacceptable risks, and would be arbitrary and capricious. Sunnyvale joins with BACWA in urging the Regional Board to eliminate the individual wasteload allocation for municipal POTWs so as to avoid a harsh and unnecessary result.

5. If the Individual Wasteload Allocations Become NPDES Permit Limits, the Regional Board May Not be Able to Revise Them in the Future Without Serious Problems Under Federal Anti-Backsliding Law, Thereby Making the Proposed Growth Cap Semi-Permanent.

⁵ The allocations to the municipal POTWs are clearly described and labeled as “wasteload allocations” at various points in the TMDL Report and the proposed Basin Plan Amendment (e.g. Table 4-x on page A-6 of the proposed Basin Plan Amendment).

⁶ 40 C.F.R. 130.2(h) states: “(h) Wasteload allocation (WLA). The portion of a receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. WLAs constitute a type of water quality-based effluent limitation.” (emphasis added)

40 C.F.R. 122.44(d)(i)(vii) states: “When developing water quality-based effluent limits under this paragraph the permitting authority shall ensure that:

(A) The level of water quality to be achieved by limits on point sources established under this paragraph is derived from, and complies with all applicable water quality standards; and

(B) Effluent limits developed to protect a narrative water quality criterion, a numeric water quality criterion, or both, are consistent with the assumptions and requirements of any available wasteload allocation for the discharge prepared by the State and approved by EPA pursuant to 40 CFR 130.7.” (emphasis added)

Although the proposed Basin Plan Amendment states that the TMDL is to be reviewed every five years, and “[a]ny necessary changes to the targets, allocations or implementation plan will be incorporated into the Basin Plan,”⁷ this intention may be completely frustrated by federal anti-backsliding requirements. Under federal anti-backsliding law, a WQBEL that is based on a wasteload allocation contained in a TMDL may be changed only if the resulting revised TMDL “will assure the attainment of such water quality standard.”⁸ This could seriously derail the Regional Board staff’s proposed approach to growth management. The Regional Board staff has explained in its response to a peer review comment that there is sufficient room in the proposed 14 kg/yr bay-wide mercury allocation to meet anticipated needs for additional treatment until 2025 (at which point the Regional Board can reassess the wasteload allocations), and it anticipates that POTWs may in the meantime be able to curtail their mercury discharges through “improvements in treatment efficiency and increased water re-use.”⁹ As pointed out in Mr. Rose’s letter, these assumptions are unfounded. The assumption that the allocations can be changed if future growth justifies it is unsupported by any anti-backsliding analysis. The failure of the Regional Board to foresee the potential impact of anti-backsliding law casts its assumptions about future relief into serious doubt.

How does the Regional Board propose in the future to “assure” the federal EPA (or a reviewing court) that an amendment granting an additional allocation to municipalities is justified? We submit that the scientifically indefensible methodology being proposed to justify the TMDL at this time would not suffice. The word “assure” implies that there is a heavy burden to carry in showing by hard data and sound scientific

⁷ Proposed Basin Plan Amendment, p. A-16.

⁸ 33 U.S.C.A. § 1313(d)(4)(A) states: “(4) Limitations on revision of certain effluent limitations.

(A) Standard not attained. For waters identified under paragraph (1)(A) where the applicable water quality standard has not yet been attained, any effluent limitation based on a total maximum daily load or other waste load allocation established under this section may be revised only if (i) the cumulative effect of all such revised effluent limitations based on such total maximum daily load or waste load allocation will assure the attainment of such water quality standard, or (ii) the designated use which is not being attained is removed in accordance with regulations established under this section.” (emphasis added)

⁹ The Staff’s assurance in its response to the peer reviewer, that: “If growth becomes a concern, for example 15 to 20 years from now, we expect to know more about how our mercury control efforts are working and have a more solid basis for determining if modification to the wasteload allocations are appropriate.” Memorandum from Bill Johnson and Richard Looker dated May 18, 2004 entitled: “Responses to Scientific Peer Review Comments, San Francisco Bay Estuary,” response number 26, at p. 7. (emphasis added)

reasoning (as opposed to the numerous scientifically indefensible “assumptions” in the currently-proposed TMDL) that the water quality standard will be attained irrespective of the additional mercury associated with growth. Such a change would undoubtedly be vigorously challenged by the federal EPA and by environmental groups. The final result could well be that the currently-proposed wasteload allocations become semi-permanent caps, thereby seriously affecting the ability of the POTWs to meet normal growth needs. How long “semi-permanent” may be is unknown at this time, but it could extend far beyond the year 2025. The Regional Board’s failure to take into account the potential for having a semi-permanent cap on mercury discharges would be arbitrary and capricious.

6. The Use Of A Far-Reaching “Interpretation” Of The Narrative Objective For Bioaccumulate Pollutants In The Basin Plan Is Illegal; The “Interpretation” Is Simply The Adoption Of A New Objective.

The proposed TMDL may not be adopted because it improperly relies on an informal “interpretation” of a policy statement in the Basin Plan, not upon a properly-adopted water quality objective. The federal Clean Water Act states that a TMDL “shall be established at a level necessary to implement the applicable water quality standards.”¹⁰ A “water quality standard” must contain “water quality criteria.”¹¹ “Applicable standard” is defined in the federal TMDL regulations to be: “a numeric criterion for a priority pollutant promulgated as part of a state water quality standard.”¹² (emphasis added) The applicable water quality standard for mercury in the South Bay is the 0.051 ug/L criterion contained in the California Toxics Rule.¹³ Because the South Bay is already in attainment with that objective, the proposed TMDL exceeds the bounds of federal law. The Regional Board is proposing to change the applicable water quality objective without compliance with the Water Code.

Further, the narrative objective for bioaccumulative pollutants may not be “interpreted” by the Regional Board as proposed in the TMDL Report, without the basis for such interpretation having been previously approved by EPA as part of the standard itself.¹⁴

¹⁰ 33 U.S.C.S. § 1313(d)(1)(C).

¹¹ 40 C.F.R. 130.2(d) states: “(d) Water quality standards (WQS). Provisions of State or Federal law which consist of a designated use or uses for the waters of the United States and water quality criteria for such waters based upon such uses. Water quality standards are to protect the public health or welfare, enhance the quality of water and serve the purposes of the Act.” (emphasis added)

¹² 40 C.F.R. 130.10(d)(4).

¹³ 65 F.R. 31681 (May 18, 2000); 40 C.F.R. 131.38(b).

¹⁴ 40 C.F.R. 131.11(a)(2).

Even assuming that the “narrative objective” were applicable in this case, neither the plain language of the “narrative objective” nor the original meaning intended when it was adopted will support such a far-reaching interpretation as the TMDL Report urges upon the Regional Board. The “narrative objective” refers to “controllable water quality factors” and states that such factors “shall not cause” a “detrimental increase in concentrations of toxic substances found in bottom sediments or aquatic life.” (emphasis added) It may not be applied to the sources which are described as noncontrollable (e.g. historic mining deposits). Nor can it be applied to sources which, due to their comparatively minute contribution, do not “cause” the observed detrimental increases, such as the municipal POTWs. We note that the so-called “narrative objective” contains only the word “cause” and not the phrase “cause or contribute,” which is used elsewhere in the federal Clean Water Act, to require the imposition of WQBELs. The TMDL Report admits that the municipal POTWS altogether generate less than 1% of the bay’s total mercury load, and thus, as a *de minimus* source, they cannot be said to be the “cause” of the mercury exceedances, within any commonly-understood meaning of the word.¹⁵

A more logical interpretation of the so-called narrative objective is that it was originally intended (and accepted by EPA) as a policy statement to guide the Regional Board in approaching certain then-unidentified sources which could be shown by evidence to be a cause of a local methylmercury problem. There is no other historic application of the narrative objective that is anywhere comparable to the overly-stretched and unreasonable reading the TMDL Report is making. We ask that the Regional Board place in the administrative record the entire regulatory history of the narrative objective, including any documents relating to the purposes for which it was originally adopted and the various administrative applications and interpretations that have been made of the narrative objective since its original incorporation into the Basin Plan.

We submit that the TMDL Report’s specific numeric “targets” extend far beyond a mere “interpretation” of the so-called “narrative objective,” and are, in fact, a form of “underground” water quality objective which is specifically designed as a subterfuge to evade the statutory protections built into the Water Code.¹⁶

¹⁵ Webster’s II New Collegiate Dictionary, for example, defines the word “cause” as follows: “1.a. Something that produces an effect, result or consequence. B. The person, event or state responsible for an action or result.”

¹⁶ The absurdity of the proposed use of the “narrative objective” becomes apparent when one considers whether the general “narrative objective” (i.e. “there shall be no chronic toxicity in ambient waters” (1995 Basin Plan, p. 3-4)) could be similarly “interpreted” to justify numeric “goals” for all other pollutants, without going through the required Water Code processes for the development of water quality objectives. Or consider the mischief which could result if the Regional Board were to similarly “interpret” the Basin Plan “narrative objective” for “Specific Chemical Constituents” which states: “Surface waters

7. The “Interpretation” Of The “Narrative Objective” Requires Compliance With Sections 13241 And 13242 Of The Water Code.

The proposed new fish tissue methylmercury “target” of 0.2 ppm,¹⁷ the bird egg mercury concentration “target” of .5 ppm, and the sediment mercury “target” of 0.2 ppm are numeric criteria that are functionally equivalent to numeric water quality objectives. They have regulatory impact which is equivalent to a water quality objective. No “interpretation” of the “narrative objective” may establish new water quality objectives without compliance with Sections 13241 and 13242 of the Water Code, which are intended by the legislature to ensure that the State Board and the Regional Board carefully weigh numerous critical factors when setting water quality objectives.

The application of the reasonableness standard set forth in Section 13241 would not permit the Regional Board to impose a cap on municipal growth. Such a cap is patently not “reasonable” when the beneficial impact on water quality, if any, is infinitesimal. If the Regional Board intends to impose a cap on municipal dischargers, it should openly declare its intention and use the legal tools available to it under the Water Code.¹⁸

8. The TMDL Report Does Not Address The CEQA Requirement To Consider The Economic Impacts Of The Proposed Cap On Mercury Discharges.

Public Resources Code Section 21159 requires the Regional Board to take into account economic factors when establishing the type of requirements contained in the Proposed Basin Plan Amendment. The economic impacts of a cap on municipal growth are not discussed in the Staff Report or in the accompanying CEQA documentation.¹⁹

shall not contain concentrations of chemical substances in amounts that adversely affect any designated beneficial use.” 1995 Basin Plan, p. 3-5

¹⁷ The proposed fish flesh “target” of .02 ppm has never been adopted as a water quality objective by the Regional Board. It represents an attempt to “adjust” the current federal recommended water quality criterion for mercury, which is the methylmercury residue in fish flesh (0.3 ppm). 66 F.R. 1344 (January 8, 2001)

¹⁸ See e.g. Water Code § 13301, which authorizes a connection ban on new sources of waste when a POTW is not in compliance with a waste discharge requirement.

¹⁹ Section 21159(c) states: “The environmental analysis shall take into account a reasonable range of environmental, economic, and technical factors, population and geographic areas, and specific sites.” See a memorandum dated October 27, 1999 from Sheila K. Vassey, Senior Staff Counsel, State Water Resources Control Board, entitled: “Economic Considerations in TMDL Development and Basin Planning.”

9. The TMDL Report Makes A Scientifically Indefensible Assumption Regarding The Relationship Between Sediment Mercury And Fish Tissue Methylmercury.

The TMDL Report states: “In the absence of additional information, reductions in mercury loads are assumed, for purposes of this report, to result in proportional reductions in fish tissue residues.”²⁰ This simplistic approach is contrary to EPA’s guidance for determining the relationship between environmental mercury and fish tissue residual methylmercury.²¹ The record for the TMDL indicates no attempt to apply either a bioaccumulation model, site-specific bioaccumulation factors or even the default bioaccumulation factors produced by EPA. We submit that the use of a linear relationship not supported by an appropriate scientific explanation would be arbitrary and capricious.²² Such an approach would not be approvable by EPA under the regulatory “scientifically defensible” test for the adoption of water quality standards.^{23 24}

²⁰ TMDL Report, at p. 48.

²¹ See 66 F.R. 1344, 1355 (January 8, 2001).

²² The use of such far-reaching and scientifically indefensible “assumptions” pervades the TMDL Report. Examples of this are: “Reductions in sediment mercury are assumed to result in proportional reductions in fish tissue and bird egg mercury concentrations.” p. S-2. “Assuming the amount of mercury needs to be reduced by about 50% to meet the proposed targets, the assimilative capacity of the Bay is about 32,000 kilograms.” p. S-2. “The allocation scheme is based on the assumption that mercury from all sources is similarly available to be converted to methylmercury and taken up into the food web.” p. S-2. “Because the active layer is assumed to have a fixed depth, its mass cannot change.” p. 15. “The sediment inputs are assumed to equal the sediment outputs.” p. 15. “The sediment steady state assumption is used to fill critical information gaps.” p. 16. “For purposes of this report, mercury loads from bed erosion from bay segments other than San Pablo Bay and Suisun Bay are assumed to be negligible . . .” p. 21. “Using Equation 1, assuming that eroding sediment from the Bay floor contains about .042 ppm mercury, and assuming that the net annual sediment loss is about 1,100 M kg/yr, the mercury load associated with the exposed sediment is roughly 460 kg/yr.” p. 22. “Agricultural land was assumed to be like open space in terms of mercury loads.” p. 23. “This approach assumes that that all sediment discharged from the Guadalupe River would be discharged with or without the mining legacy.” p. 27. “Assuming the sediment load entering the bay equals the sediment load leaving the bay, the Golden Gate load equals the sum of the sediment loads entering the bay minus the other sediment losses.” p. 32. “The mercury load in exported sediment is assumed to come from all over San Francisco Bay.” p. 32. “Most modeling in support of mercury TMDLs has been based on an assumption that reducing mercury loads to the environment will have a proportional effect in reducing fish tissue concentrations (DTMC and SWRP 2002).” p. 48. “In the

10. There Is No “Necessity” For The Municipal Growth Cap, Within The Meaning Of The California Administrative Procedures Act.

The proposed Basin Plan amendment, if adopted, is subject to review by the Office of Administrative Law under Government Code Section 11349. Among the criteria listed for OAL is the “necessity” for the proposed regulation. How “necessary,” indeed, is the proposed municipal growth cap in order to ensure that fish taken from the bay may be safely eaten without observing the quantity restrictions contained in the applicable fish advisory? The TMDL Report itself claims that the bay will attain the proposed “target” through natural processes, “without any specific implementation measures”²⁵ According to the TMDL Report, the bay cleanses itself of mercury in such a

absence of additional information, reductions in mercury loads are assumed for the purposes of this report, to result in proportional reductions in fish tissue residues.” p. 48. “In the absence of additional information, however, reductions in bird egg concentrations are assumed for purposes of this report, to be proportional to reductions in fish tissue mercury.” p. 49. “Assuming that the amount of mercury in San Francisco Bay needs to be reduced by about 50% to meet the proposed targets, the assimilative capacity of the bay is about 32,000 kilograms.” p. 50. “The proposed allocations are based on the assumption that mercury from all sources is equally available to be converted to methylmercury and incorporated within the food web.” p. 51. “This report assumes that the same amount of bed erosion will continue indefinitely. It also assumes that the mercury concentrations of eroding sediment will drop to .02 ppm. . . . As a result, the mercury load will eventually drop to about 220 kg.yr without any specific implementation measures.” p. 53. “The model accounts for San Francisco Bay mercury inputs and outputs and relies on assumptions about how sources and losses will change over time.” p. 59. “The proposed plan involves measuring progress towards meeting the proposed targets, and, as necessary, re-evaluating the validity and appropriateness of the assumptions underlying the analysis.” p. 61. “The allocation scheme assumes that all methylmercury reductions in fish and wildlife must come from total sediment reductions in the bay sediment.” p. 62. “The proposed allocation is based on the assumption that mercury from all sources is similarly available to be converted to methylmercury and taken up into the food web.” p. 64. (emphasis supplied)

²³ See 40 C.F.R. 131.11(d).

²⁴ Although the TMDL Report has undergone a form of scientific peer review, the results of that process do not validate the scientific leaps that the TMDL Report is making. We join with Robert Falk, attorney for SCVURPPP, in the objections to the peer review process which he is making in his letter of comment to the Regional Board. Also, the peer review process does not, of course, justify or excuse any of the regulatory and legal flaws pointed out in this letter.

²⁵ TMDL Report, p. 53.

manner and at such a rate that, at the end of the 120 to 200 year period, the environmental mercury in the bay will attain a safe level and continue to decline indefinitely.²⁶ The presence or absence of a cap on municipal growth will not materially affect the outcome of this process. At worst, the final attainment date could be delayed for a very short time in a very long attainment period. We submit that the Regional Board would not prevail with OAL on the “necessity” issue if the regulation is adopted as proposed because the imposition of a drastic bay-wide growth curb is not “necessary.”

Thank you for the opportunity to provide comments on this important rulemaking.

Very sincerely yours,

Robert C. Thompson

Cc: Adam W. Olivieri, EOA, Inc.
Thomas W. Hall, EOA, Inc.
Marvin A. Rose, City of Sunnyvale
Donna A. Scott, City of Sunnyvale
Lorrie Gervin, City of Sunnyvale

²⁶ Ibid.

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June 7, 2004

Bill Johnson, Environmental Scientist and
Richard Looker, Water Resources Control Engineer
San Francisco Bay Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

Subject: Comments on the Proposed San Francisco Bay Mercury TMDL Basin Plan Amendment

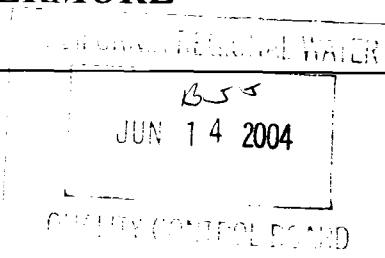
Dear Messrs. Johnson and Looker:

The City of Livermore appreciates the opportunity to comment on the proposed San Francisco Bay Mercury TMDL Basin Plan Amendment. The Livermore Water Reclamation Plant holds an NPDES permit with a permitted average dry weather discharge not to exceed 8.5 million gallons per day. Currently, the plant discharges an average of 6.5 mgd. The City, along with the Dublin San Ramon Services District (DSRSD) and City of Pleasanton, are members of the Livermore Amador Valley Water Management Agency (LAVWMA). Effluent from the Livermore Water Reclamation Plant, and the DSRSD Regional Wastewater Treatment Plant (which also treats wastewater from Pleasanton), is discharged into the LAVWMA export system where it is eventually disposed of in the San Francisco Bay through the East Bay Dischargers Authority outfall.

The City of Livermore strongly opposes the approach that has been taken to allocate the mercury wasteload. The Proposed San Francisco Bay Mercury TMDL Basin Plan Amendment and Staff Report states that "allocations were computed on the basis of each facility's fraction of the entire municipal wastewater category mercury load from 2000 through 2003." No consideration was given to POTWs that have performed well. If the proposed Basin Plan Amendment is adopted, the City of Livermore will be unfairly penalized for having had a history of low mercury levels in its effluent; the Regional Water Quality Control Board will create a mercury problem for the City of Livermore where one did not exist. Also, adoption of the current mercury wasteload allocation will not allow Livermore to implement its recently updated General Plan without exceeding its mercury allocation, since no provisions for growth are included in the allocation.

Inequity in Proposed Allocations

The inequity in the proposed wasteloads is evident when comparing the allocations proposed for the municipal wastewater dischargers in the Livermore Amador



Valley. According to Table 7.3: Proposed Wasteload Allocations for Individual Municipal Wastewater Dischargers, the City of Livermore would be assigned an allocation of 0.090 kg/yr of mercury, while a neighboring agency, DSRSD, would be allocated a mercury wasteload of 0.52 kg/yr. Livermore's current average discharge flow is about 6.5 mgd. DSRSD's discharge flow currently averages about 11.5 mgd, about 77% greater than Livermore. Yet, DSRSD has been assigned an allocation that is 478% greater than Livermore, despite having a similar service area and treatment process. This situation demonstrates the inequity in the Regional Water Quality Control Board's approach to the mercury wasteload allocations.

In addition, the City of Livermore's allocation is half what was proposed in the June 6, 2003 draft, while DSRSD's allocation has been increased by 79%. The June 6, 2003 allocations were based on the facility's fraction of the entire municipal wastewater category mercury load from 1999 - 2001. The currently proposed wasteload allocations are based on the fractional flows from 2000-2003. The data from 2000-2003 are supposedly more accurate because ultra-clean sampling and analytical methods were required beginning January 1, 2000. The Regional Water Quality Control Board notified POTWs of this requirement in a letter dated August 4, 1999. In a second letter dated October 22, 1999, the initiation date for implementing the ultra-clean sampling and analytical methods was postponed until January 1, 2000; the requirements were clarified, and a waiver until January 1, 2001 was granted to the requirement for using only certified laboratories for compliance analyses using EPA Method 1631 for mercury. The City of Livermore did not delay in its compliance with the new requirements and submitted samples to a certified, experienced analytical laboratory in the state of Washington (Brooks-Rand, Ltd) until the California lab currently being used became certified for EPA Method 1631. The City of Livermore proactively chose to send samples to an out-of-state lab to assure reliable and accurate mercury data.

No Relief from Additional Source Control Strategies

If the proposed Basin Plan Amendment is adopted, the Regional Water Quality Control Board would require the development and implementation of mercury source control programs to minimize significant mercury sources. However, BACWA has provided evidence that for well-run treatment plants with comprehensive pretreatment and pollution prevention programs, the effluent mercury concentrations appear to be independent of influent mercury concentrations, and that it is therefore expected that additional pollution prevention programs will not necessarily result in actual reductions of mercury loads.

Livermore has been proactive and conscientious in its approach toward mercury and already has mercury source control programs in place. In July 1999, mercury was chosen as one of the constituents to focus on because of the move toward Total Maximum Daily Load (TMDL) calculations for impaired receiving waters throughout the State. Mercury was chosen out of concern for ultimate discharge capacity, based on the potential impacts of the extremely low concentration limit being proposed for the next NPDES permit, and the prospect of a mass limit being imposed based on the results of the Mercury TMDL. Information and data were gathered on sources and possible control strategies. It was estimated that the majority of the mercury in the influent wastewater, about 62%, is from domestic sources. The City's efforts regarding

domestic mercury sources have been directed towards identifying the residential contribution, supporting efforts to ban mercury-containing products statewide, and implementing outreach strategies such as thermometer exchange programs. The Association of Metropolitan Sewerage Agencies study, Evaluation of Domestic Sources of Mercury (August 2000), indicated that the levels of mercury in domestic wastewater vary with time of year, and may result from differences in the number of amalgam surfaces per individual, fish/shellfish consumption rates, water usage, water source, and rates of mercury settling/re-suspension in sewers. Human wastes (feces and urine) from amalgam-loaded individuals are believed to be the most significant (>80%) source. It noted that controlling human wastes is impractical.

Lawrence Livermore National Laboratory (LLNL) contributes about 14% of the mercury loading. The City of Livermore's source control staff continues to work with LLNL representatives to minimize the mercury discharges from LLNL. However, additional control strategies are likely to yield little improvement since most of the mercury in LLNL's discharge to the Livermore Water Reclamation Plant is from mercury that has historically accumulated in the existing piping system.

The City of Livermore will soon begin implementing a dental mercury program. However, based on the 2003 average influent mercury, even if the remaining 24% of the influent mercury load can be attributed to dental offices, eliminating the dental mercury discharge would not significantly reduce the influent mercury.

Allocation Curtails Growth

The proposed wasteload allocation for the City of Livermore could curtail the City's future growth, or at a minimum subject the City to certain violation of the mercury allocation at build out. Professor David Sedlak noted the lack of a term to allow for growth in his Proposed Mercury TMDL 2003 Peer Review Comments. In response, the Regional Water Quality Control Board acknowledged that it chose not to allocate a portion of the TMDL for future growth. It responded, "...the Association of Bay Area Governments' year 2025 growth projections for the Bay Area suggests that there will be modest (~14% region wide) population growth over that period. We believe modest influent flow increases could be offset both by slight improvements in treatment efficiency and increased water re-use; therefore, the mercury allocations will not pose a compliance challenge to wastewater treatment plants or necessitate flow limitations. If growth becomes a concern, for example 15 to 20 years from now, we expect to know more about how our mercury control efforts are working and have a more solid basis for determining if modifications to the wastewater allocations are appropriate."

It is unreasonable to consider the 14% growth rate as applicable to all POTWs. Livermore's flow is projected to increase by 23% above the current design flow, and about 62% above current dry weather flow. As previously noted, the Livermore Water Reclamation Plant is currently permitted for 8.5 mgd. At a flow of 9.0 mgd, and the current daily average 0.009 ug/L mercury concentration, the wasteload would already be at the proposed 0.09 kg/L allocation. At the projected buildout flow of 10.5 mgd and the current daily average mercury concentration of

0.009 ug/L, the mercury wasteload in the effluent would be 0.130 kg/year, exceeding the proposed allocation.

Improvements in treatment efficiency and increased water reuse are cited as offsetting increases resulting from growth. The low levels of mercury in the effluent from the Livermore Water Reclamation Plant demonstrate the already high treatment efficiency of the plant. Increased water reuse may not offset growth and help the City of Livermore meet the proposed allocation. Drinking water is supplied by groundwater from the Livermore Amador Valley Groundwater Basin that underlies the Livermore Amador Valley. Because of concerns with increasing salts in the groundwater basin, salts from irrigation with recycled water must be mitigated. The Livermore Amador Valley wastewater agencies, DSRSD and City of Livermore, together with the manager of the groundwater basin, Zone 7 Water Agency, have developed a Salt Management Program. Groundwater demineralization has been identified as a key method for controlling salt loading from recycled water irrigation, with the demineralization concentrate disposed of in the LAVWMA export pipeline. Preliminary data from Zone 7 indicate that the concentrate may contain 0.004-kg/month of mercury.

In conclusion, the proposed mercury wasteload allocation for the City of Livermore is not an equitable allocation. The City of Livermore is in essence being penalized for having been proactive in its approach to mercury analysis, and for a history of low mercury levels in its effluent. The wasteload allocation will curtail the City of Livermore's ability to build out its General Plan without certain violation of the mercury mass limit. Remedies in the proposed implementation plan are not effective remedies for the City of Livermore to overcome future compliance challenges that would be imposed by the proposed mercury wasteload allocation.

The City of Livermore strongly objects to the adoption of the mercury TMDLs as outlined in the proposed San Francisco Bay Mercury TMDL Basin Plan Amendment dated April 30, 2004. The Regional Water Quality Control Board is urged to adopt a more equitable mercury wasteload allocation for the City of Livermore.

Sincerely,



Darren Greenwood
Water Resources Manager

Copy: Dan McIntyre, Public Services Director
Helen Ling, WR Regulatory Compliance Officer
Mark Rios, Operations & Maintenance Supervisor
Kumudini Dharmawardana, Lab Coordinator

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June 14, 2004

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Via Messenger and Email

Mr. Bill Johnson
Mr. Richard Looker
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Oakland, California 94612

**Re: Proposed Basin Plan Amendment – Total Maximum Daily Load for
Mercury in San Francisco Bay Basin/Implementation Plan**

Dear Mr. Johnson and Mr. Looker:

These comments on legal issues are submitted on behalf of the Santa Clara Valley Urban Runoff Pollution Prevention Program ("SCVURPPP" or "Santa Clara Municipalities")¹ with regard to the above-referenced proposed Total Maximum Daily Load, Implementation Plan, and related Basin Plan Amendment concerning the regulation of mercury in San Francisco Bay dated April 30, 2004 (collectively, "TMDL"). The Santa Clara Municipalities will provide you with separate additional comments on other technical, programmatic, and policy issues of concern. Several of the municipalities have or will also be submitting comments individually.²

The Santa Clara Municipalities thank the members of the Regional Board staff who have worked on this TMDL. Each has shown professionalism in this process, and we appreciate the difficult and challenging task assigned to them. The result of their efforts is a document that reflects a large volume of technical information, attempts to cope with numerous uncertainties, and undoubtedly seeks to balance the input and perspectives of many individuals and constituencies holding disparate views.

¹ The Santa Clara Municipalities are composed of 13 cities and towns in the Santa Clara Valley, the County of Santa Clara, and the Santa Clara Valley Water District; these entities share a common NPDES permit to discharge municipal storm water to South San Francisco Bay.

² The comments submitted below, as well as others being submitted by the Santa Clara Municipalities either individually or collectively are not intended to and do not waive any grounds of legal argument not discussed below; they also do not constitute admissions.

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Unfortunately, while the Santa Clara Municipalities congratulate the Regional Board staff on their efforts, we cannot support adoption of the TMDL or related Basin Plan Amendment in their current form and instead believe substantial revision is required.

* * * * *

EXECUTIVE SUMMARY

The proposed TMDL, Implementation Plan, and Basin Plan Amendment raise a number of complex legal, technical, and practical issues of concern to the Santa Clara Municipalities. The following are among the key legal issues:

1) The proposed approach reflected in the TMDL is not legally authorized under Federal Clean Water Act ("CWA") and California Porter Cologne Act ("Water Code") requirements. Among other things, adopting a mercury TMDL for the *South San Francisco Bay* is improper because:

- a) the water quality standard/objective for mercury related to the use for which the South Bay was listed under CWA section 303(d) (i.e., 0.51 ug/L as duly promulgated by US EPA in the California Toxics Rule) is *not* being exceeded;
- b) the TMDL allocates loading and associated reductions from air deposition, bedded sediments, Caltrans, and other *uncontrollable* sources to urban runoff; and
- c) the urban runoff provisions in the TMDL (and particularly in the proposed Implementation Plan) have not been properly analyzed within the framework of the CWA's unique maximum extent practicable ("MEP") standard for municipal stormwater dischargers, especially in the South Bay where the Basin Plan already recognizes unique circumstances need to be considered;

2) The scientific peer review questions for the TMDL were not properly formulated, and, hence, render the peer review inadequate;

3) There has been a failure to comply with the California Environmental Quality Act ("CEQA") in terms of sufficiently evaluating the impacts of, alternatives to, and burdens to be imposed by the TMDL; and

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4) Adoption of the TMDL's allocation to urban runoff and Implementation Plan provisions concerning urban runoff would create an unfunded mandate in violation of the California Constitution by imposing significant burdens on local governments without providing resources for funding them.

LEGAL COMMENTS

I. The Proposed Approach taken in Developing this TMDL is Not Authorized under Applicable Clean Water Act and Porter Cologne Act Requirements

The staff has structured this TMDL by establishing so-called "numeric targets" for wildlife (expressed as a bird egg mercury concentration below 0.5 ppm) and sport fishing and human health (expressed as a fish tissue mercury concentration 0.2 ppm). These initial targets are then related through a "linkage analysis" to a third "numeric target" of 0.2 ppm of mercury in sediment to form the critical parameter by which loading is allocated and implementation of load reduction targets is measured. These "numeric targets" are not legally authorized and, hence, cannot form the basis of this TMDL.

Specifically, the numeric targets do not support the TMDL's proposed application to the South San Francisco Bay because:

1) As part of the California Toxics Rule ("CTR"),³ US EPA has already officially promulgated the *only* numeric water quality mercury standard/objective that applies in the South San Francisco Bay to the use that is the subject of the CWA section 303(d) listing triggering the TMDL, and the data contained in the Staff Report indicate that it is being met. The Regional Board cannot legally employ its narrative water quality standard/objective (or further translation of it into numeric targets) to supplant the duly adopted CTR standard/objective.

2) TMDL-derived numeric targets may be developed to address only those particular impairments for which the water bodies were previously identified and listed under CWA section 303(d) and/or confirmed by assessment under CWA section 305(b). South San Francisco Bay has been listed as impaired for mercury only on the basis of fish consumption advisories, not harm to bird eggs or protection of wildlife habitat. The numeric targets for wildlife therefore are not authorized.

3) Even if they were appropriate (and they are not for the South Bay), "numeric targets" cannot be calculated on the basis of novel criteria or avoid required procedures

³ The CTR was published at 65 Fed. Reg. 31,682 (May 18, 2000).

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for the promulgation of water quality standards/objectives. Before a numeric target can be established as an “interpretation” of existing narrative water quality standards/objectives, US EPA must have already approved the translation procedures as part of the water quality standard/objective, and it has not done so here. In addition, where a TMDL’s translation makes use of novel parameters and is inconsistent with prior practice, as has been the case here,⁴ it amounts to *de facto* establishment of a new water quality standard/objective and necessitates analysis pursuant to section 13241 of the Water Code;⁵

4) Insofar as the TMDL sets any of its numeric targets and resulting allocations, load reduction targets, and related implementation plans to address the current Basin Plan’s narrative water quality standard/objective for bioaccumulative substances, it imposes requirements that are not authorized because sources of mercury in the South San Francisco Bay are not “controllable” as defined by the Basin Plan, and the narrative’s bioaccumulation standard/objective applies only to sources that are “controllable”; and

5) The TMDL’s proposed allocation to urban runoff and related load reduction targets, timetable, and Implementation Plan provisions fail to address the Clean Water Act’s unique “maximum extent practicable” (“MEP”) standard for municipal stormwater and are inconsistent with prior State Board precedent decisions regarding the application of numeric regulatory criteria to stormwater.

We explain these issues in more detail immediately below.

⁴ As recently as January 2004, the Regional Board regulated discharges of mercury to the South San Francisco Bay based only on the CTR’s numeric standard/objective and *not* a translation of a narrative standard/objective. See Waste Discharge Requirements issued to the U.S. Fish & Wildlife Service re: South San Francisco Bay Low Salinity Salt Ponds.

⁵ The TMDL’s use of a target based on whole mercury concentrations in sediment is also inconsistent with the TMDL approaches being pursued in the Guadalupe River Watershed and in the Central Valley which focus on the more reliably determined level of methylmercury in fish tissue as the key regulatory parameter.

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A. The TMDL Cannot Use Numeric Targets Derived from a Translation of a Narrative Standard/Objective When US EPA Has Already Promulgated an Applicable Numeric Mercury Standard/Objective for the South San Francisco Bay

The Staff Report proposes a numeric target of 0.2 ppm mercury in fish tissue – a number calculated to “translate” the Basin Plan’s narrative water quality objective limiting bioaccumulative substances.⁶ While ingestion of mercury from fish consumption is a potential public concern, this in itself does not mean either that the Basin Plan’s narrative bioaccumulative substances standard/objective is applicable in South San Francisco Bay or that a mercury TMDL for this body of water is appropriate. The opposite is the case here because, in the CTR, US EPA promulgated the *exclusive* legally applicable *numeric* water quality standard/objective for protection of human health in South San Francisco Bay and, as a result, the Regional Board is not permitted to substitute its *narrative* water quality standard/objective (or numeric targets purporting to translate this narrative standard/objective) as the appropriate basis for further regulatory action.⁷

For toxic pollutants such as mercury, when a state (or US EPA in the absence of state action) has adopted a numerical water quality standard/objectives to protect a use, it is the *exclusively* applicable basis for a TMDL. The regulations state:

For purposes of listing waters under § 130.10(d)(2), applicable standard means a numeric criterion for a priority pollutant promulgated [by either US EPA or the State] *as part of* a state water quality standard. Where a state numeric criterion for a priority pollutant is *not* promulgated as part of a state water quality standard, for the purposes of listing waters “applicable

⁶ Staff Report at 11, 36. The basis for this and the TMDL’s related mercury-in-sediment numeric target are the staff’s beliefs that: 1) threats to human health from San Francisco Bay fish consumption are demonstrated by California state fish advisories, 2) the Basin Plan’s narrative criterion to limit bioaccumulative substances is a legally applicable water quality objective corresponding to that threat that may not be exceeded, and 3) as a result, the CWA *obligates* the Regional Board to develop this TMDL to address the claimed impairment affecting human health. *Id.* at 13.

⁷ Although the TMDL states: “US EPA recommends that states adopt their own water quality criteria using local consumption data (US EPA 2001)” (Staff Report at 35), the Regional Board cannot do so in this TMDL. As discussed in section I.C below, if the Regional Board wishes to pursue such a policy, it may adopt a new numeric water quality standard/objective only through appropriate procedures (including compliance with Water Code Section 13241) and only after appropriate public review and comment.

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standard” means the state narrative water quality criterion to control a priority pollutant (*e.g.*, no toxics in toxic amounts).⁸

The CWA regulations make clear that the exclusive water quality standards/objectives that can be used for a TMDL are the applicable numeric standards/objectives *when they have been published* and that narrative criteria may be used *only in their absence*.⁹

In the CTR, US EPA previously promulgated a numerical water quality standard/objective for mercury applicable to the South San Francisco Bay to protect public health from fish consumption. As the Staff Report acknowledges, the CTR’s standard/objective is .051 µg/L and *is currently being met*.¹⁰ Since no exceedance of the *applicable* numerical water quality standard/objective can be demonstrated as to the South Bay, given the section 303(d) listing, all components of the TMDL must be withdrawn as to this water segment.

In addition, application of the TMDL’s proposed Bay-wide numeric targets to the South San Francisco Bay in lieu of the duly promulgated .051 µg/L numerical water quality standard/objective contradicts longstanding policy concerns reflected in the existing Basin Plan, which states:

The South Bay below the Dumbarton Bridge is a unique, water-quality-limited, hydrodynamic and biological environment that merits continued special attention by the Regional Board. *Site-specific water quality objectives are absolutely necessary in this area* for two reasons. First, its unique hydrodynamic environment dramatically affects the environmental fate of pollutants. Second, potentially costly nonpoint source pollution control measures must be implemented to attain any objectives for this area. The costs of those measures must be factored into

⁸ 40 C.F.R. § 130.10(d)(4) (emphasis added).

⁹ When the CTR was issued, US EPA also explained the reason numeric standards/objectives are to be used for TMDL purposes where they have been promulgated:

Numeric criteria for toxic pollutants allow the State and EPA to evaluate the adequacy of existing and potential control measures to protect . . . human health. Numeric criteria also provide a more precise basis for deriving . . . *wasteload allocations for total maximum daily loads (TMDLs)* to control toxic pollutant discharges. Congress recognized these issues when it enacted section 303(c)(2)(B).

65 Fed. Reg. at 31,684 (emphasis added).

¹⁰ 40 C.F.R. § 131.38 (b)(1); Staff Report at 8.

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economic impact considerations by the Regional Board in adopting any objectives for this area.¹¹

The proposed Basin Plan amendment that accompanies the TMDL does not alter the longstanding requirement for site-specific objectives below the Dumbarton Bridge (“SSO-Dumbarton”). Until the requirement for SSO-Dumbarton objectives is met through an appropriate rulemaking and supersedes or complements the .051 µg/L numerical water quality standard/objective set forth by US EPA in the CTR, the application of the TMDL’s numeric targets to South San Francisco Bay is legally impermissible.

B. TMDL Derived Numeric Targets Must Address the Particular Impairments Previously Identified for a Water Segment Listed under CWA Section 303(d), and the South San Francisco Bay Has Not Been Listed on the Basis of a Harm to Bird Eggs or Protection of Wildlife

A TMDL is essentially the third and last of three major steps which begins when authorities act under CWA section 303(d) to identify a particular water body segment as impaired and set forth the reasons the segment is officially so listed.¹² A TMDL may address only those impairments for which the water body was identified and listed under section 303(d). 40 C.F.R. § 130.7(c)(1). Here, the State has listed the South

¹¹ Basin Plan at pp. 3-5 (emphasis added).

¹² US EPA explains:

“Clean Water Act § 303(d) established the TMDL process to guide application of state standards to individual water bodies/watersheds. The process has three steps:

1. Identify Quality Limited Waters – States must identify and prepare a list [§ 303(d) list] of waters that do not or are not expected to meet water quality standards after applying existing required controls (e.g., minimum sewage treatment technology).
2. Establish Priority Waters/Watersheds – States must prioritize waters/watersheds and target high priority waters/watersheds for TMDL development.
3. Develop TMDLs – *For listed waters*, States must develop TMDLs that will achieve water quality standards, allowing for seasonal variations and an appropriate margin of safety. A TMDL is a quantitative assessment of water quality problems, contributing sources, and load reductions or control actions needed to restore and protect individual water bodies.”

US EPA, Region 9, TMDL Fact Sheet, <http://www.epa.gov/docs/region09/water/tmdl/fact.html> (emphasis added).

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San Francisco Bay for mercury based on concerns with regard to fish and wildlife *consumption* only.¹³ The 303(d) listing for this water segment states:

Current data indicate fish *consumption* and wildlife *consumption* impacted uses: health *consumption* advisory in effect for multiple fish species including striped bass and shark.¹⁴

Consumption of fish and wildlife are the *only* uses that form the basis of the current section 303(d) listing and that this TMDL may legally address. The Staff Report is *incorrect* when it states: "All segments of San Francisco Bay appear on the list because mercury impairs the bay's established beneficial uses, including . . . preservation of rare and endangered species, and wildlife habitat."¹⁵ Biological criteria or standards to address threats to the wildlife itself (*e.g.*, bird egg targets) as opposed to human consumption of fish or wildlife have not previously been made the basis for listing and, hence, are not an appropriate subject in this TMDL.¹⁶

¹³ In fact, the Regional Board has itself previously acknowledged that "mercury's effects on wildlife were *not* listed in the 303(d) finding of impairment." California Regional Water Quality Control Board, San Francisco Bay Region, Watershed Management of Mercury in the San Francisco Bay Estuary: Total Maximum Daily Load Report to US EPA at 35 (June 30, 2000) <http://www.swrcb.ca.gov/rwqcb2/download/aug00HgTMDL.pdf>.

¹⁴ CWA Section 303(d) List of Water Quality Limited Segment, approved by US EPA July 2003, <http://www.swrcb.ca.gov/tmdl/docs/2002reg2303dlist.pdf> (emphasis added).

¹⁵ Staff Report at 1.

¹⁶ The 2002-2003 303(d) list meaning of the terms "fish consumption" and "wildlife consumption" does not refer to the consumption of fish by endangered or threatened species or wildlife. These terms refer to consumption by humans. *See* California Office of Environmental Health Hazard Assessment, Chemicals in Fish: Consumption of Fish and Shellfish in California and the United States at 10 (October 2001) <http://www.oehha.ca.gov/fish/pdf/fishconsumptionrpt.pdf>; US EPA, Guidance for Conducting Fish and Wildlife Consumption Surveys (November 1998) <http://www.epa.gov/waterscience/fish/fishguid.pdf>. At the time the 303(d) list was compiled, US EPA had made a finding that no impacts to the eating habits of endangered or threatened species had been documented. When US EPA promulgated the CTR to establish water quality criteria for segments, including South San Francisco Bay, it stated:

As part of the consultation process, EPA submitted to the Services a Biological Evaluation for their review in October of 1997. This evaluation found that the proposed CTR was not likely to jeopardize the continued existence of any federally listed species or result in the destruction or adverse modification of designated critical habitat. In April of 1998, the Services sent EPA a draft Biological Opinion which tentatively found that EPA's proposed rule would jeopardize the continued existence of several Federally listed species and result in the destruction or have adverse effect on designated critical habitat. After lengthy discussions with the Services, EPA agreed to several changes in the final rule and the Services in turn issued a final Biological Opinion finding that EPA's action would not likely jeopardize the continued existence of any Federally listed species or result in the destruction or adverse modification of designated critical habitat.

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While protecting wildlife species and habitat may ultimately be desirable, those are *not* the uses for which CWA technology-based limits have been found unable to achieve water quality standards/objectives. Before a TMDL can address these goals, this alleged additional use impairment must be formally identified and subjected to public comment through the listing process for the South San Francisco Bay. To the extent the TMDL seeks to establish a numeric target to address mercury in bird eggs or rare and endangered species, it is not legally appropriate and must be withdrawn, at least insofar as the South Bay is concerned.¹⁷

C. Adoption of the Proposed “Numeric Targets” Would Amount to the Illegal Adoption of a New Water Quality Standard/Objective – Before Translating Narrative Standards into Numeric Targets, the State Must Specify and US EPA Must Approve the Translation Procedures; Hence a Water Code Section 13241 Analysis is Also Required for the Numeric Targets Proposed

The Staff Report appears to offer the explanation that adoption of its numeric targets will not amount to the setting of numerical water quality standards/objectives but instead only involves the “interpretation” or “translation” of the existing narrative water quality standards/objectives.¹⁸ However, adoption of the proposed numeric targets here will impermissibly go well beyond mere translation or interpretation, does not comply with applicable regulatory requirements, and amounts to the *de facto* setting of new water quality standards or objectives.

65 Fed. Reg. 31,709 (May 18, 2000).

Newer evaluations of the alleged threat to wildlife are only first proposed now in this TMDL (*see* Staff Report at 37) on the basis of USFWS studies published in 2003. The public has not had an opportunity to comment on such findings as part of the listing of the water body segment under CWA section 303(d). Until that opportunity is available, the basis for listing South San Francisco Bay does not include the wildlife threats for which the numeric target is proposed.

¹⁷ This conclusion is fully consistent with US EPA policy: “If the State determines a TMDL is not necessary after the TMDL development process has begun, the State would normally stop work on the TMDL” *See* EPA Guidance for Developing TMDLs in California at 3 (January 7, 2000) <http://www.epa.gov/docs/region09/water/tmdl/caguidefinal.pdf>.

¹⁸ “Numeric targets for mercury concentrations in suspended sediment, fish tissue, and bird eggs are needed to translate water quality objectives into monitoring metrics that reflect the beneficial uses to be protected.” Staff Report at 11.

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1. The Proposed Numeric Targets are Arbitrary and Capricious; the Translator Mechanism/Method has Not Previously been Promulgated and Approved as is Required

The numeric targets proposed here are not legally authorized because they are not based on approved and duly promulgated translation mechanisms/methods. US EPA previously defined what it considers appropriate elements of the water quality standard/objective-setting process when using narrative criteria for toxic pollutants such as mercury. The standard/objective itself must include *not only* a narrative statement expressing the appropriate quality of water to support uses, *but also a US EPA-approved procedure to calculate derived numeric criteria* based on the narrative standard when applied to CWA actions such as a TMDL. As far back as 1988, US EPA stated:

Where a State elects to supplement its narrative criterion with an accompanying implementing procedure, it *must* formally adopt such a procedure *as a part of* its water quality standards. The procedure must be used by the State to calculate derived numeric criteria that [will] be used as the basis for all standards purposes, including: developing TMDLs¹⁹

To pass legal muster, setting of a numeric target corresponding to a narrative criterion must be preceded by formal adoption and US EPA approval of a “translator mechanism.”

EPA believes that adoption of a narrative standard along with a translator mechanism *as part of* a State’s water quality standard satisfies the substantive requirements of the statute. These criteria are subject to all the State’s legal and administrative requirements for adoption of standards plus review and either approval or disapproval by EPA, and result in the development of derived numeric criteria for specific section 307(a) toxic pollutants.²⁰

¹⁹ US EPA, Guidance for State Implementation of Water Quality Standards for CWA § 303(c)(2)(B), December, 1988, p. 14. (“1988 Guide”) (emphasis added). This guidance was later adopted more formally again in 1994. See footnote 22 below, Handbook, p. 3-20. Earlier in 1983, US EPA stated: “Where narrative criteria are adopted, the State should indicate *as a part of* its water quality standards submission how it intends to regulate the discharge of the toxic pollutants.” 48 Fed. Reg. 51,402 (Nov. 8, 1983) (emphasis added).

²⁰ 1988 Guide at 10 (emphasis added).

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This same US EPA Guidance goes on specify: “States must adopt a specific *procedure* to be applied to a narrative water quality criterion. To satisfy section 303(c)(2)(8), this procedure shall be used by the State in calculating derived numeric criteria, which criteria *shall be used* for all purposes under section 303(c) of the CWA.”²¹

These US EPA directions have been codified in CWA implementing regulations and instructions for water quality standards development. For example, US EPA’s water quality standards regulations for toxic pollutants state:

Where a State adopts narrative criteria for toxic pollutants to protect designated uses, the State must provide information *identifying the method* by which the State intends to regulate point source discharges of toxic pollutants on water quality limited segments based on such narrative criteria.²²

²¹ 1988 Guide at 11 (emphasis added).

²² 40 C.F.R. § 131.11(a)(2) (emphasis added). US EPA’s directions to implement the regulation confirm the need to include translation procedures as part of approved standards: “Section 131.11(a)(2) requires States to develop implementation procedures which explain how the State will ensure that narrative toxics criteria are met.” Water Quality Standards Handbook: Second Edition (1994) <http://www.epa.gov/waterscience/library/wqstandards/handbook.pdf> (“Handbook”).

Lest the above leave room for doubt, US EPA expressly clarified in its interpretation of the CWA’s regulations that implementing procedures for narrative criteria must accompany the plain narrative statements and must be formally adopted and approved:

The Procedure Must Be Formally Adopted and Mandatory

Where a State elects to supplement its narrative criterion with an accompanying implementing procedure, it must formally adopt such a procedure *as a part of its water quality standards*. The procedure must be used by the State to calculate derived numeric criteria that will be used as the basis for all standards’ purposes, including the following: developing TMDLs, WLAs

The Procedure Must Be Approved by EPA as Part of the State’s Water Quality Standards Regulation

To be consistent with the requirements of the Act, the State’s procedure to be applied to the narrative criterion must be submitted to EPA for review and approval, and *will become a part of the State’s water quality standards*. (See 40 C.F.R. 131.21 for further discussion.)

Handbook, p. 3-22 (emphasis added).

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With regard to wildlife protection considerations, the CWA also specifies that in the absence of numeric criteria/objectives, biological monitoring or assessment *methods* – such as those necessary to document or support the Staff Report’s conclusions or proposals – must be adopted first and are clearly *part and parcel of* the water quality standard/objective establishment process:

[Water quality] criteria shall be specific numerical criteria for such toxic pollutants. Where such numerical criteria are not available, whenever a State reviews water quality standards pursuant to paragraph (1), or revises or adopts new standards pursuant to this paragraph, such State *shall adopt* criteria based on biological monitoring or assessment *methods* consistent with information published pursuant to section 304(a)(8).²³

US EPA has provided substantial guidance to states defining the ways in which wildlife numeric targets – “biological criteria” – should be developed in order meet the CWA goal for the protection and propagation of wildlife by means of a TMDL.²⁴ Briefly, US EPA’s guidance sets out a stepwise procedure to: 1) establish clear statements of biological criteria, 2) evaluate local conditions with careful study of reference conditions appropriate to the area, 3) perform quantifiable biological surveys, 4) employ “hypothesis testing” to ensure that the true causes of any biological impairment are properly documented, and 5) develop the implementation measures that properly respond to measures of impairment.²⁵

As the technical comments being submitted on behalf of Santa Clara County demonstrate, the proposed TMDL does not meet US EPA’s standard for such studies because, among other things: a) its measurement of mercury in bird eggs is inaccurate, b) there is no reference site analysis concerning its evaluation of bird egg/survival issues, c) causation of “wildlife harm” has not adequately been linked to mercury

²³ CWA § 303(c)(2)(B).

²⁴ CWA § 101(a)(2); US EPA, Biological Criteria: National Program Guidance for Surface Waters (April 1990) <http://www.epa.gov/waterscience/library/wqstandards/handbookappx.pdf> (Handbook, Appendix C); US EPA, Procedures for Initiation of Narrative Biological Criteria (October 1992) <http://www.epa.gov/ost/biocriteria/technical/brochure.pdf>. US EPA explains that use of the Appendix C procedure helps States to meet CWA § 303(d) TMDL obligations. Handbook, Appendix C, p. 10.

²⁵ Although the State and US EPA may have developed a translator mechanism as part of the CTR for metals, it does not apply to procedures for wildlife protection criteria involving mercury. See 40 C.F.R. § 131.38; 62 Fed. Reg. 42,160 (Aug. 5, 1997). US EPA has acknowledged the current difficulties, lack of data, or useable models necessary to develop a procedure that could lead to a numeric target for ecological effects or wildlife receptors. California Toxics Rule Response to Comments Report (December 1999) <http://www.epa.gov/waterscience/standards/ctr/responses.pdf>.

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concentrations in bird egg shells, and d) there has been a failure to perform testing of null hypotheses.

2. Because the TMDL's Numeric Targets Represent More than Authorized "Translation" and instead are *De Facto* Water Quality Standards/Objectives, Compliance with Water Code Section 13241 is Required

Although the Staff Report purports merely to "interpret" an existing water quality standard/objective, use of these numeric targets would take place without the required approval process governed by other formal statutory and Administrative Procedure Act ("APA") requirements.²⁶ Specifically, in California, before novel translation methods create *de facto* water quality standards/objectives, they must first be subject to analyses under section 13241 of the Water Code.²⁷ Water Code section 13241 requires that, at a very minimum, the following factors be analyzed in advance of Regional Board action:

(a) Past, present, and probable future beneficial uses of water.

(b) Environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto.

(c) Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area.

(d) Economic considerations.

²⁶ See for example *Simpson Tacoma Kraft Co. v. Department of Ecology*, 119 Wash.2d 640, 835 P.2d 1030 (1992) (affirming a superior court's ruling that Washington State could not develop a numeric standard for dioxin based on narrative standards without going through rulemaking procedures).

²⁷ While the staff can be expected to claim that the Chief Counsel's Office of the State Water Resources Control Board has authorized the type of translation activities undertaken here, it is important to recognize that the Chief Counsel also recognizes that there must be limits to this process and that some portions of a TMDL can amount to the adoption of formal water quality standards/objectives and not mere translation:

Although entire TMDLs, their primary elements, and their implementation plans are not water quality standards, *in some instances other parts of a California TMDL may be standards* subject to section 303(c)(3), and thus the Alaska Rule.

Memo from Michael Levy, SWRCB Office of Chief Counsel, to Paul Lillebo at 5 (January 28, 2002) (emphasis added).

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(e) The need for developing housing within the region.

(f) The need to develop and use recycled water.

Under the California APA, this section 13241 analysis must be made available to the public and subjected to comment in advance of the Regional Board's contemplated action.

Here, even if it were not legally required (and it is), the Regional Board should direct that the staff prepare a full and adequate section 13241 analysis and circulate it for public comment. It makes practical and policy sense for the Regional Board to know, at the time it considers the TMDL for adoption, what, for example, the likely economic and housing burden of this proposed twenty plus year regulatory plan entails.²⁸ As the existing Basin Plan SSO-Dumbarton objective requires with respect to the South San Francisco Bay, the Regional Board also needs to consider the water quality conditions that could *reasonably* be achieved through the coordinated control of all factors which uniquely affect water quality *in the area*.

Indeed, at least one California court has found that a regional board is in violation of 40 C.F.R. § 131.11(a)(2) when it fails to identify the method in its Basin Plan of how it intends to translate a narrative objective into useable numeric equivalents for CWA purposes.²⁹ Such translation methods can only be adopted pursuant to Water Code section 13241.³⁰

In sum, until the Regional Board staff completes a Water Code section 13241 analysis and publishes and receives approval for its translator mechanism or procedures, the numeric targets in the TMDL cannot be utilized.

²⁸ As discussed below and in comments submitted directly by the Santa Clara Municipalities, the Staff Report's discussion of impacts and costs is incomplete, seriously flawed, and inadequate to meet the requirements of either the California Environmental Quality Act ("CEQA") or Water Code section 13241.

²⁹ *City of Los Angeles Bureau of Sanitation v. State Water Resources Control Board*, Los Angeles Superior Court, Case BS 060 957, Statement of Decision April 4, 2001, p. 10. The case has been appealed by the State on other grounds, but this ruling of the court has not been appealed and remains the law of the case.

³⁰ See *Ibid.* p. 9.

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D. The Narrative Criterion for Bioaccumulative Substances on Which the TMDL is Based Applies Only to “Controllable” Water Quality Factors; Sources of Mercury Subject to this TMDL are Not “Controllable” as Defined By the Basin Plan

Even if it were appropriate to “translate” numeric targets for mercury (and, it is not, particularly with regard to the lower South Bay), any such “translation” is authorized only to the extent the current Basin Plan defines the term “controllable” as used in its narrative bioaccumulative standard/objective:

Many pollutants can accumulate on particles, in sediment, or bioaccumulate in fish and other aquatic organisms. *Controllable* water quality factors shall not cause a *detrimental increase* in concentrations of toxic substances found in bottom sediments or aquatic life. Effects on aquatic organisms, wildlife, and human health will be considered.³¹

In adopting its narrative standards/objectives and utilizing the term “controllable,” the Basin Plan further explains:

The Board recognizes that limited information exists in some cases [and] makes it difficult to establish definitive numerical objectives, but the Board believes its conservative approach to setting [narrative] objectives has been proper. In addition to technical review, *the overall feasibility of reaching objectives in terms of technological, institutional, economic, and administrative factors is [to be] considered at many different stages of objective derivation and implementation*

When uncontrollable water quality factors result in the degradation of water quality beyond the levels or limits established herein as [narrative] water quality objectives, the Board *will conduct a case-by-case analysis of the benefits and costs* of preventing further degradation Controllable water quality factors are those actions, conditions, or circumstances resulting from human activities that may influence the quality of the waters of the State and that may be *reasonably* controlled.

³¹ Staff Report at 9 (emphasis added).

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Compliance with [narrative] water quality objectives *may be prohibitively expensive or technically impossible* in some cases [T]he Board will conservatively *compare benefits and costs* in these cases because of the difficulty in quantifying beneficial uses.³²

The Regional Board must perform a feasibility and cost/benefit analysis before making decisions or prescribing implementation measures based on a Basin Plan objective that is limited to actions that are “controllable.” The sources of mercury the TMDL identifies and proposes to regulate by means of the Basin Plan amendment may be controlled to some degree generally but not to the degree the Staff Report would require.

Among other things, the TMDL appears to assume, without analysis, that a mercury discharge is “controllable” simply because it happens to land on or pass through the geographical boundaries of a municipality subject to regulation by the Regional Board. For example, mercury from air deposition is assumed to be completely uncontrollable when it lands directly on San Francisco Bay, but completely controllable through urban runoff permits when it happens to land within an NPDES-permitted municipality. Nowhere is feasibility of the municipality’s ability to control the source of the pollutant or cost/burden of treating this aspect of an urban runoff allocation even discussed. The TMDL fails to consider that *both* may be equally uncontrollable, particularly when, as here, the origin of the mercury (power plants in China) is geographically so distant.³³

Therefore, if it is to remain consistent with the existing Basin Plan, a much more rigorous analysis to tell the difference between what is truly controllable and what is not is necessary before the TMDL can legally be adopted.³⁴

³² Water Quality Control Plan for the San Francisco Bay Basin (1995), p. 3-1-2 (emphasis added).

³³ As discussed in the Santa Clara Municipalities’ comments being submitted by the SCVURPPP, mercury already present in bank and bed sediments of tributaries to the South Bay is not a point source discharge properly subject to a waste load allocation to or control by urban runoff programs and, hence, should also be deducted from the urban runoff allocation currently set forth in the proposed Basin Plan Amendment.

³⁴ The Basin Plan’s bioaccumulation substances criterion is also forward-looking or prospective in character. It refers only to “detrimental *increases*” of toxic substances in sediments and not to effects from concentrations already present as a result of historical activity. Prospective controls such as the numeric targets and related load reductions described in the Staff Report that do not separate out the effects of existing sediment levels would *unreasonably* regulate conditions that are not “increases.” Hence, it appears that historical conditions, such as the legacies of mining present in the South Bay,

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E. The Clean Water Act's Unique Standard for Municipal Stormwater Discharges has Not Been Accounted For in Constructing the Allocation to Urban Runoff; the Implementation Plan is Inconsistent with Prior State Decisions Regarding the Application of Numeric Regulatory Standards to Stormwater – The Urban Runoff Allocation and Related Implementation Plan Parameters Must be “Practicable”

In addition to addressing Water Code section 13241 and the SSO-Dumbarton provisions of the Basin Plan (and CEQA's requirements), the Regional Board must take into account feasibility and potential costs in establishing the TMDL's allocation to urban runoff and in crafting numeric reduction targets, timetables, and other provisions of the proposed implementation plan because the feasibility and cost of achieving an allocation is a critical element in determining whether it meets the CWA's practicability standard for municipal stormwater discharges.

The Clean Water Act draws a distinction between NPDES permits for industrial stormwater discharges and NPDES permits for discharges from MS4s. The NPDES permitting requirements for stormwater discharges are found at Section 402(p) of the CWA. Subsection 402(p)(3)(A) provides that permits for industrial stormwater discharges “shall meet all applicable provisions of this section and [CWA section 301.]” Section 301 of the CWA is entitled “effluent limitations” and 40 C.F.R. section 122.44(d)(5) requires that permits incorporate limitations (such as WQBELs) “established under Federal or State law or regulations in accordance with section 301(b)(1)(C) of CWA.”

In contrast, CWA section 402(p)(3)(B), which governs permits for discharges from MS4s, does not require that such permits meet the requirements of CWA section 301. Rather, permits for MS4 discharges must “require controls to reduce the discharge of pollutants to the maximum extent practicable” (“MEP”). Thus, while the CWA may require that NPDES permits for industrial stormwater dischargers contain WQBELs, Congress did not contemplate requiring WQBELs (or any other traditional form of effluent limitations) in NPDES permits for MS4s; instead, they are subject to “controls” under the different MEP standard.

should not be subject to the Basin Plan's bioaccumulation standard/objective or a TMDL (including any numeric target, or load reduction derived therefrom).

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This interpretation of the CWA was confirmed in *Defenders of Wildlife v. Browner*, 191 F.3d 1159 (9th Cir. 1999). There, the Ninth Circuit concluded that

Congress' choice to require industrial storm-water discharges to comply with [CWA section 301], but not to include the same requirement for municipal discharges, *must be given effect*. When we read the two related sections together, we conclude that [CWA section 402(p)(3)(B)(iii)] does not require municipal storm-sewer discharges to comply strictly with [CWA section 301(b)(1)(C).]

191 F.3d at 1165 (emphasis supplied).³⁵

While the Regional Board may have certain discretionary authority under section 402(p)(B)(iii) to impose certain additional "controls" on MS4s in certain circumstances, even this discretion is *limited*. Specifically, the additional controls must not demand more than the maximum extent practicable.

The allocation to urban runoff and Implementation Plan and timetable proposed here *has not even been analyzed for practicability*. Since controls extending beyond the limit of practicability are not authorized for MS4s under the CWA and *Browner*, and this fundamental principle remains true even in circumstances where TMDLs need to be implemented, adoption of the TMDL and Implementation Plan should not proceed at this time.

Indeed, under the CWA, it is not even necessary for the Regional Board to adopt an implementation plan at the same time it adopts a TMDL and submits the TMDL to the State Board and US EPA for approval. The Santa Clara Municipalities and the Bay Area Stormwater Management Agencies Association ("BASMAA") have repeatedly advocated separating the "technical" portion of the TMDL from the more policy sensitive related Implementation Plan aspect of its Basin Plan Amendment as such is permissible under US EPA regulations and would maximize State control and autonomy over the process.

³⁵ Because the Ninth Circuit has determined that the CWA does not require MS4s to strictly comply with section 301(b)(1)(C), the regulations promulgated pursuant to section 301(b)(1)(C), including those set forth in 40 C.F.R. section 122.44(d), are equally inapplicable to MS4s. See *Komarenko v. Immigration & Naturalization Service*, 35 F.3d 432, 436 (9th Cir. 1994) ("In order to be valid, a regulation must be consistent with its enabling statute."); see also *Aerolineas Argentinas v. United States* 77 F.3d 1564, 1575 (Fed. Cir. 1996) ("When a statute has been repealed, the regulations based on that statute automatically lose their vitality. Regulation do no maintain an independent life, defeating the statutory claim.").

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Moreover, many aspects of the TMDL and Implementation Plan are highly impracticable and, hence, cannot be legally imposed with respect to urban runoff, particularly with regard to the Santa Clara Valley Municipalities. For example:

- The necessary allocation to urban runoff has been grossly overestimated. As the Santa Clara Municipalities' comments graphically illustrate, if improved estimates of bed erosion from the Bay based on updated data from the U.S. Geological Survey and more accurate estimates of loadings contained in urban and non-urban stormwater runoff exclusive of bedded sediments would be employed in the TMDL's calculations, *dramatically lower* loading and much more practicable load reduction targets could be assigned to urban runoff sources; projected recovery time for the Bay would also be halved from the TMDL's current projection, even without any additional control efforts and their associated fiscal and planning burden on local governments;
- The percentage mercury load reductions proposed in conjunction with the TMDL's allocations to the Guadalupe Mining Legacy (98%) and Urban Runoff (approximately 50%) are not only unnecessary, they are *grossly disproportionate* to the reductions being imposed on other sources, including those not even subject to the MEP constraint imposed under the CWA;
- Even though they hold NPDES permits and are subject to WQBELs, wasteload allocations and reduction targets for Caltrans and stormwater discharges associated with industrial and construction activities *have not even been estimated or directly assigned to them*; MS4s are instead being asked to address and be given responsibility for waste loads from sources within their geographic boundaries, including Caltrans and Air Quality Management District-regulated air emitters (among others), over which they *lack* any control or jurisdiction;
- Contrary to the Basin Plan, no analysis has been conducted to even suggest that load reductions of the magnitude specified (90 kg/year for the Guadalupe and 78 kg/yr for Urban Runoff of which 21.38 kg/year is to come from the Santa Clara Municipalities) are *even within the control* of those MS4s being asked to address them; for example, by the Staff Report's own admission, almost one-third (55 kg/year of the 160 kg/yr load estimated for urban runoff) comes from atmospheric deposition;
- The timetables and milestones specified under the Implementation Plan have *not* been derived or informed by any analysis of what is practicable in terms of

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MS4 programs;³⁶ twenty year time horizons are not practicable for achieving the magnitude of load reductions specified (and ten year time horizons for achieving half of these reductions are even more far-fetched);

- MS4s, like the Santa Clara Municipalities, which have already undertaken mercury elimination and sediment removal/control programs are receiving *no credit* for these efforts under the TMDL even though they have contributed and will contribute to load reductions;
- The overall Urban Runoff allocation has been assigned among Bay Area MS4 programs on the basis of *current* population rather than land mass, anticipated new development, or other factors more likely to be tied to mercury;
- Total estimated costs for the Santa Clara Municipalities to address the proposed WLA and load reduction targets presented in the TMDL and Implementation Plan are *\$40 million to \$50 million per year for capital costs* and *\$63 million to \$78 million per year for ongoing costs* (e.g., operation and maintenance, reporting); and
- Perhaps most importantly, rather than set forth the allocations and associated load reduction targets as goals to be “addressed” by MS4s, the proposed Implementation Plan goes well *beyond* the CWA’s TMDL “consistency” requirement and violates the MEP standard, the Ninth Circuit’s decision in *Browner*, and prior State Board precedent decisions³⁷ by stating that MS4s will be assigned responsibility for “demonstrating compliance with” or “achieving” the numeric load reduction targets.

³⁶ According to Mr. Looker’s comments at the May 25, 2004 Bar Association of San Francisco seminar on this TMDL, the timetables in the Implementation Plan were informed by the State Implementation Plan (“SIP”) concerning the CTR. However, because of the MEP standard, the SIP on its face, *does not apply* to municipal stormwater discharges. (It is also seemingly inconsistent that the State Board prescribed a 20 year timetable for implementation of the CTR’s standards/objectives (i.e., .051 µg/L for mercury in the South Bay) in the SIP where the TMDL’s Implementation Plan only proposes to provide that amount of time to achieve more ambitious and burdensome results.)

³⁷ SWRCB Order Nos. 91-03, 91-04, 96-13, 98-01; *see also* Order Granting Petition for Writ of Mandate and Statement of Decision in *S.F. BayKeeper v. RWQCB, SF Region* (SF Superior Court Case No. 500527), Nov. 14, 2003 at 1-2.

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II. The Questions Regional Board Staff Presented to Peer Reviewers for the TMDL Were Not Properly Formulated

The Regional Board was required to solicit peer review of the scientific conclusions supporting its TMDL pursuant to Health and Safety Code section 57004.³⁸ Peer reviews from three University of California experts were solicited under this "Problem Statement" defining the issues posed by the TMDL:

The Problem Statement

This section of the report describes the basis for concluding that mercury impairs San Francisco Bay, including the water quality standards not being met. High levels of mercury have been found in fish, including the fish humans eat, and birds, including the endangered California clapper rail and least tern. Mercury levels in San Francisco Bay exceed the Basin Plan objective for bioaccumulation and threaten beneficial uses, such as sport fishing, wildlife habitat, and preservation of rare and endangered species.³⁹

³⁸ Health and Safety Code § 57004(d) states:

(d) No board, department, or office within the agency shall take any action to adopt the final version of a rule unless all of the following conditions are met:

(1) The board, department, or office submits the scientific portions of the proposed rule, along with a statement of the scientific findings, conclusions, and assumptions on which the scientific portions of the proposed rule are based and the supporting scientific data, studies, and other appropriate materials, to the external scientific peer review entity for its evaluation.

(2) The external scientific peer review entity, within the timeframe agreed upon by the board, department, or office and the external scientific peer review entity, prepares a written report that contains an evaluation of the scientific basis of the proposed rule. If the external scientific peer review entity finds that the board, department, or office has failed to demonstrate that the scientific portion of the proposed rule is based upon sound scientific knowledge, methods, and practices, the report shall state that finding, and the reasons explaining the finding, within the agreed-upon timeframe. The board, department, or office may accept the finding of the external scientific peer review entity, in whole, or in part, and may revise the scientific portions of the proposed rule accordingly. If the board, department, or office disagrees with any aspect of the finding of the external scientific peer review entity, it shall explain, and include as part of the rulemaking record, its basis for arriving at such a determination in the adoption of the final rule, including the reasons why it has determined that the scientific portions of the proposed rule are based on sound scientific knowledge, methods, and practices.

³⁹ Peer Review of Technical Basis of Proposed Basin Plan Amendment for Mercury TMDL for San Francisco Bay, October 24, 2003.

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As a statement of the problem and charge to the peer reviewers, we object to the formulation that the staff provided of relevant questions. It is an assumption to say – and in our view incorrect – that mercury levels exceed all objectives in South San Francisco Bay or that the beneficial uses are threatened, two assertions that are themselves the kind of conclusion for which a peer review is necessary.

Because the peer reviewers were told to accept these and other premises as given “facts,” they were not in a position to exercise scientific judgment on the underlying bases or data to controvert those issues in their peer review product. Had the inquiry been pursued appropriately, the peer reviewers could very well have indicated that the assumptions underlying this TMDL – that all mercury is the same and that sediment mercury concentrations relate proportionately to fish tissue levels (among others) – do not reflect the current state of the science on these issues. See, for example, the comments being submitted on this TMDL by Exponent Corporation on behalf of the Santa Clara Valley Water District.

As a result we request that the Regional Board direct the staff to retract its posted peer review of the TMDL and restate the problem for further peer review analysis pursuant to the Health and Safety Code’s requirements.

III. There has been a Substantial Failure to Comply with CEQA in terms of Evaluating the Impacts of, Alternatives to, and Burdens to be Imposed by the TMDL and its Implementation Plan

A. Environmental Impacts

Before the Regional Board may approve the Basin Plan amendment, it must prepare an environmental impact report (“EIR”) or a functionally equivalent document (“FED”). Pub. Res. Code § 21080.5(a). When preparing the FED, the Regional Board must comply with CEQA. Pub. Res. Code § 21080.5(c). The Regional Board must also comply with the State Board’s regulations for the preparation of FEDs. 23 C.C.R. §§ 3775-3781.

The FED must describe the Basin Plan amendment, identify and consider reasonable alternatives to the Basin Plan amendment, identify any significant adverse environmental impacts of the Basin Plan amendment, and propose mitigation measures to minimize the significant adverse environmental impacts of the proposed TMDL and

http://www.swrcb.ca.gov/rwqcb2/TMDL/SFBayMercury/instructions_to_reviewers.pdf. See responses at <http://www.swrcb.ca.gov/rwqcb2/sfbaymercurytmdl.htm>.

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Basin Plan amendment. Pub. Res. Code § 21080.5(d)(3); 14 C.C.R. § 15252; 23 C.C.R. § 3777.

CEQA requires the Regional Board to analyze both the direct and the indirect impacts of the Basin Plan amendment. 14 C.C.R. § 15358. The Regional Board may not approve the Basin Plan amendment if the Basin Plan amendment would have a significant environmental impact and there are feasible alternatives or feasible mitigation measures available which would substantially lessen the significant impacts of the project. Pub. Res. Code § 21081.

Accordingly, the Regional Board must consider the impacts of the TMDL and proposed Basin Plan amendment (especially its Implementation Plan) in light of the criteria for significance established pursuant to section 21083(b) of CEQA. In particular, the Regional Board must find that the TMDL and proposed Basin Plan amendment would have a significant effect on the environment if they have the potential to degrade the quality of the environment or to achieve short-term environmental goals to the disadvantage of long-term environmental goals. Pub. Res. Code § 21083(b).

Such findings must be made here. The Staff Report has incorrectly concluded that the Basin Plan amendment would not have a significant effect on the environment. (Staff Report at 106.) Significant impacts are likely to result from this TMDL and its allocations and load reduction targets for the Guadalupe Mining Legacy and Urban Runoff. The Staff Report even identifies several categories of "Direct and Indirect Physical Changes," including: (1) minor construction; (2) earthmoving operations; and (3) waste handling and disposal likely to result from the TMDL and admits that these activities are reasonably foreseeable. (Staff Report at B-12, B-14.)⁴⁰

The Staff Report also mentions that mercury reduction activities could include sediment removal and disposal using dump trucks. As the Santa Clara Municipalities' comments explain, approximately 47,000 truck loads of material would need to be removed from storm drain facilities each year to meet the proposed WLA for urban runoff. This represents a five-fold increase from current storm drain maintenance activities, which is clearly significant.

⁴⁰ The Staff Report acknowledges that the Basin Plan amendment would have impacts on the environment, but impermissibly dismisses the significance of these impacts and avoids any meaningful analysis thereof because the "exact nature of these changes is often speculative pending specific project proposals." (Staff Report at B-14.). The Staff Report does not provide any legitimate basis for this speculation; nor, as discussed below, does it contain substantial evidence that the impacts in question would be less than significant.

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The types of stormwater detention/retention practices that the Staff Report indicates would be required to avoid the need for extensive sediment removal, transportation, and waste disposal activities could substantially increase the risk of vector-borne disease. (See Declaration of Tim Mulligan, Santa Clara County Vector Control District Manager, attached as *Attachment A*.)⁴¹ Standing water is a prime breeding habitat for disease-carrying insects, such as mosquitoes. Mosquitoes can carry various diseases, such as encephalitis and malaria, which pose a serious threat to public health. (*Id.*)

As Santa Clara Valley Water District explained to the Regional Board staff in comments on a prior version of the San Francisco Bay Mercury Total Maximum Daily Load Project Report, the removal of significant amounts of riparian soil for purposes of removing mercury would have significant impacts on vegetation since the mercury was deposited. The impact on vegetation and fisheries habitat therefore must be carefully analyzed pursuant to CEQA before the TMDL can legally be adopted. Those negative impacts may be more severe than the alleged harms to wildlife staff claims are attributable to the mercury itself – a “cure worse than the disease.”

The TMDL and proposed Basin Plan amendment would also have an indirect but reasonably foreseeable significant impact on land use, air quality, and traffic because they would increase the cost of residential development in the Santa Clara Valley and displace some of that development to rural areas to the south and the east. Activities undertaken by the Santa Clara Municipalities as conditions of approval of specific projects in order to address the Santa Clara Municipalities’ Urban Runoff allocation are likely to drive up the cost of residential, commercial, and industrial development in Santa Clara County. The increase in the cost would displace development to rural areas outside of the San Francisco Bay Region, such as in Santa Cruz County, Stanislaus County, Merced County, San Benito County, and Monterey County.

Therefore, in addition to its impacts on waste hauling and disposal, vector issues and riparian habitat, the proposed Basin Plan amendment, among other things, would have a significant impact on the following aspects of land use, traffic, and air quality:

- Displaced residential development would result in urban sprawl, which would be inconsistent with local plans;
- Residents of the displaced residential development would suffer longer commute, but would likely continue to commute by car. Public

⁴¹ We specifically request that this and all other prior submissions on Project Reports related to this TMDL be made part of the record.

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transportation is generally limited between areas south and east of Santa Clara County the San Francisco Bay Region and the commercial and industrial areas in Santa Clara County. Consequently, longer commutes would result in increased vehicle-miles, which would result in increased traffic, particularly along major highways such as U.S. Highway 101; and

- Longer commutes and increased vehicle-miles would also result in increased vehicle emissions, which would degrade air quality.

As the City of San Jose previously explained in response to the Regional Board's proposed NPDES permit requirements for new development and redevelopment ("C.3 requirements"), the required sediment controls would impose substantial costs on the City and would have adverse impacts on the production of housing, the revitalization of downtown San Jose, and the local economy. (*See Comments of the City of San Jose on the Regional Board's Tentative Order dated May 18, 2001, attached as Attachment B.*) The City's prior comments remain highly relevant to the TMDL and proposed Basin Plan amendment, because the Staff Report indicates that implementation of the C.3 requirements is a primary part of the TMDL's Implementation Plan.

As the result of these and other measures that will be necessary to address the TMDL's mercury sediment targets and associated load allocations and reductions (possibly including the construction of *massive* storm water detention and treatment facilities), the Basin Plan amendment would likely result in significant impacts, drive up both municipal and development costs, and create dislocations and associate secondary impacts.⁴² A more rigorous CEQA environmental impact analysis is therefore required.

B. Mitigation Measures

The Staff Report does not comply with CEQA because it defers mitigation analysis until an undetermined later date without establishing any standard or guidance or requirement for the deferred mitigation. (Staff Report at B-14.) The Staff Report shifts also impermissibly the mitigation obligation to subsequent lead agencies, stating: "As specific implementation proposals are developed and proposed, lead agencies

⁴² In particular, the City's comments note that detention/retention basins, which could also be necessary to achieve the allocation under the Basin Plan Amendment, substantially reduce the amount of developable land, particularly where on-site detention/retention is required. (San Jose Comments at 7-10.) These types of control measures would also significantly increase the cost of development and render certain projects infeasible, shifting development to outlying areas. (San Jose Comments at 11.) The displaced development would be farther from transit opportunities and would conflict with the City's plans to curtail urban sprawl. (San Jose Comments at 11-12.)

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would undertake environmental review and identify specific environmental impacts and appropriate mitigation measures.” (Staff Report at B-14.)

Deferred mitigation is generally *unacceptable*, especially where, as with the proposed Basin Plan amendment, there can be little doubt that significant environmental impacts will be created. *See Sundstrom v. County of Mendocino* (1988) 202 Cal.App.3d 296. In certain cases, the Regional Board may defer the formulation of mitigation measures where further study is necessary to determine the nature of the significant impacts or the appropriate design for the mitigation measures. *Sacramento Old City Association v. City Council of Sacramento* (1991) 229 Cal.App.3d 1011, 1028. However, in such cases, the Regional Board must establish a *standard* for determining what sort of mitigation measure is appropriate and must commit *itself* to adopting the mitigation measure when it is formulated. *Id.*⁴³

The Regional Board should instead analyze and consider adoption of feasible measures to mitigate the significant impacts of the proposed Basin Plan amendment *now*, in conjunction with this process. At a minimum, the Regional Board should direct its staff to prepare an environmental review document that more fully satisfies the requirements of, and extent of analysis associated with, an environmental impact report (“EIR”) prior to adopting any Basin Plan amendment containing an implementation plan for the TMDL.

C. Alternatives Analysis

To comply with CEQA, the Regional Board must also consider reasonable alternatives to the proposed Basin Plan amendment. 23 C.C.R. § 3777. The Staff Report briefly considers eight alternatives to the proposed Basin Plan amendment, but this is inadequate because none of the alternatives would address any of the significant environmental impacts of the proposed Basin Plan amendment.

Significantly, the Staff Report only considers one alternative that varies the implementation schedule – a “Faster Implementation” alternative, under which the Implementation Plan would be accelerated into full effect in just ten years. The Staff Report should also consider other alternatives, particularly alternatives under which the

⁴³ The Regional Board staff’s attempt to shift the mitigation obligation to subsequent lead agencies is particularly egregious in light of the fact that, as the Regional Board is well aware, the Regional Board is exempt from the mitigation requirements of CEQA when adopting or amending NPDES permits. In addition, the NPDES permit, once adopted, is likely to constrain the authority of municipalities and other public agencies to develop effective measures to mitigate the indirect environmental impacts that would result from the increased costs of development.

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Implementation Plan would be phased in over twenty-five, thirty, or forty years.⁴⁴ These alternatives could give the Santa Clara Municipalities members and other public agencies *greater flexibility* in allocating resources to and managing mercury reduction activities, thereby lessening some of the economic and environmental impacts of and dislocations and secondary impacts associated with the proposed Basin Plan amendment. These alternatives could also give the Santa Clara Municipalities and other public agencies the opportunity to take advantage of additional advances in remediation, treatment, and monitoring technology. Moreover, based on Figure 7.2 of the Staff Report, it appears that these alternatives might not materially change the point at which mercury-related water quality standards/objectives throughout the Bay will ultimately be achieved.⁴⁵

D. Economic Burdens to be Imposed

The Regional Board must prepare an economic analysis for the Basin Plan amendment which identifies reasonably foreseeable methods of achieving the load allocations and considers the economic impact of those methods. In developing the TMDL and the allocations, the Regional Board must give the same consideration and weight to economic factors as is required under section 13241 in order to comply with CEQA. The Regional Board may not dismiss the methods of compliance with the load allocations as “speculative,” nor may the Regional Board shift the burden of conducting an economic analysis to the public.

As the State Board Chief Counsel’s office has explained:

[T]he Regional Water Board must identify the reasonably foreseeable methods of compliance with the wasteload and load allocations and consider economic factors for those methods.

⁴⁴ In addition, as suggested in the Santa Clara Municipalities’ comments submitted by the SCVURPPP, alternatives based on the use of different assumptions concerning bed erosion from the Bay and a separate non-point source load allocation to stream/creek bank and beds (as distinguished from urban runoff) should be assessed. Alternatives based on treating the South Bay as a separate “box,” assigning portions of the urban runoff allocation based on factors other than current population, and for understanding how a regulatory approach might work if based on methylmercury should also be evaluated.

⁴⁵ According to Mr. Richard Looker of the Regional Board, the Regional Board has a simple Excel spreadsheet model available which allows the Regional Board to estimate the amount of time necessary for the sediment mercury concentrations to reach the sediment target, depending on the schedule for implementing the allocations. This spreadsheet model would appear to allow the Regional Board to estimate the amount of time necessary for the sediment mercury concentrations to reach the sediment target if the Implementation Plan were phased in over twenty-five, thirty, or forty years rather than twenty years.

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This economic analysis is similar to the analysis for water quality objectives [as required by section 13241 of the Water Code and guidance from the Chief Counsel of the State Board to the Regional Boards]. *That is, the Regional Water Board should determine: (1) whether the allocations are being attained; (2) if not, what methods of compliance are reasonably foreseeable to attain the allocations; and (3) what are the costs of these methods.*

(Memorandum from Sheila K. Vassey, Senior Staff Counsel for the State Board, to Stefan Lorenzato, TMDL Coordinator for the Division of Water Quality of the State Board at 5 (Oct. 27, 1999) (emphasis added).)

The Staff Report's purported economic analysis is insufficient to meet these applicable legal requirements. It grossly underestimates some of the costs of implementing the urban runoff provisions of the Basin Plan amendment and completely ignores most of the other costs that will be borne by the Santa Clara Municipalities.

a) Cost of Sediment Removal, Erosion Control, Treatment, Waste Disposal, Source Reduction

The Staff Report relies on information provided by EOA Inc. for its analysis of the cost of mercury reduction activities by the Santa Clara Municipalities to achieve the allocation for urban runoff. However, the Staff Report mischaracterizes the estimates EOA provided. (See Staff Report at 103.)

EOA provided a "very preliminary rough" estimate of the cost to the Santa Clara Municipalities of implementing the provisions regarding urban runoff as proposed by BASMAA on September 17, 2003. Contrary to the suggestion in the Staff Report, EOA did not estimate the cost of the mercury TMDL-related activities listed in the proposed Basin Plan amendment for urban runoff.

Indeed, the Basin Plan amendment proposes significantly different and additional requirements, the cost of which will likely be *much greater* than the estimate asserted in the Staff Report. In particular, the sediment removal and disposal costs, the capital costs of constructing treatment controls, and the costs of operation and maintenance for treatment controls would likely be *orders of magnitude* higher than the estimate presented in the Staff Report. As explained in the Santa Clara Municipalities' comments, the Santa Clara Municipalities have prepared an updated and more thorough estimate of the total costs for the Santa Clara Municipalities to address the proposed WLA and load reduction targets presented in the TMDL and Implementation Plan.

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According to the Santa Clara Municipalities estimate, the total costs would be *\$40 million to \$50 million per year for capital costs and \$63 million to \$78 million per year for ongoing costs.*

US EPA recently confirmed the *critical importance* of the cost of implementation when determining best management procedures for urban runoff and stormwater controls. US EPA withdrew a proposed new source performance standard (“NSPS”) for construction and development, because US EPA found that the proposed NSPS would be too expensive to implement. 69 Fed. Reg. 22,472, 22,480-81 (Apr. 26, 2004). According to the Federal Government, the cost of the proposed NSPS would have been in excess of \$3.3 billion per year. 69 Fed. Reg. at 22,480. Even though US EPA withdrew the proposed NSPS, the Santa Clara Municipalities likely will need to require similar management procedures for specific projects. Even then, this alone is unlikely to address most of the load reduction target associated with their proposed allocation.

In sharp contrast to the approach taken in the Staff Report, the Central Valley Regional Water Quality Control Board (“Central Valley Regional Board”) has pursued a more credible economic analysis in its development of a mercury TMDL for the Sacramento-San Joaquin Delta Estuary. In order to analyze the economic impacts of the TMDL, as required under the California Environmental Quality Act (“CEQA”) and guidance from the State Board counsel, the Central Valley Regional Board asked the U.S. Geological Survey (“USGS”) to prepare a written report regarding the cost of mercury reduction activities in the Delta watershed (“Delta TMDL Cost Data”). The Delta TMDL Cost Data describes per unit costs of mercury reduction activities in the Delta watershed. The high end and low end per unit costs are summarized in table 9.2 of the Staff Report. (Staff Report at 103.) The per unit costs identified in the Delta TMDL Cost Data for mercury reduction activities indicate that the cost of achieving the allocations in the proposed Basin Plan amendment could impose a *massive burden on public agencies* and development projects.⁴⁶

⁴⁶ According to Dave Drury, an engineer at the Santa Clara Valley Water District (“District”) who is familiar with mercury reduction activities undertaken by the District, the per unit cost of mercury reduction activities to achieve the Santa Clara Municipalities allocation would be similar to the high-end per unit cost estimates identified in the Delta TMDL Cost Data.

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To assure compliance with CEQA, the Regional Board should, at the very minimum, prepare a written report of cost data for the Basin Plan amendment similar to the Delta TMDL Cost Data prepared by the Central Valley Regional Board.⁴⁷

IV. Adoption of the TMDL's Allocation to Urban Runoff and Related Provisions of the Implementation Plan would Create an Unfunded Mandate by Imposing Significant Burdens on Local Governments Without Providing Resources for Funding them

The TMDL's allocation to urban runoff and related provisions of its Implementation Plan concerning urban runoff create an unfunded mandate on the Santa Clara Valley Municipalities in violation of the California Constitution. *See* Cal. Const. Art. 13B § 6. Under the California Constitution, the State is required to reimburse local governments for State mandated programs. *See* Cal. Const. Art. 13B § 6. While the CWA is a federally mandated program, case law makes clear that the prohibition on unfunded mandates applies, unless the State has "no true choice" in the manner of implementing the federal program. *See Hayes v. Commission on State Mandates*, 11 Cal.App.4th 1564, 1593 (1992) (emphasis added).

Here, the State, through the Regional Board, has a very real choice about whether to impose these requirements on Santa Clara Valley Municipalities. US EPA's water quality standard/objective for mercury in *South San Francisco Bay* is *not* being exceeded; as a result, no TMDL for mercury *in the South Bay* is required, and both US EPA and the Federal Courts (*see Browner*) have issued no mandate to impose WQBELs or similar requirements on municipal stormwater dischargers either in excess of the MEP standard or based on the particular numeric targets the Regional Board staff has proposed to rely on here.

Hence, the costs associated with the TMDL's urban runoff allocation and the related Implementation Plan requirements are not "costs mandated by the federal government" and may not be imposed in the absence of a concurrent provision of funding to the local government entities involved. Cal. Gov't Code § 17513. Accordingly, because no funding is provided and there are real and significant costs that would be associated with the implementation of the requirements contained in the TMDL (*see supra*, Section III.C), it constitutes an illegal unfunded mandate under State law.

⁴⁷ According to Alexander Wood, the USGS staff person who prepared the Delta TMDL Cost Data, a similar written report likely could be prepared for the proposed Basin Plan amendment.

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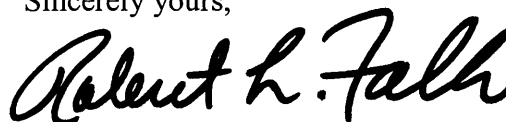
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CONCLUSION

The Regional Board staff should be commended for its effort and the work it had accomplished to date in developing a mercury TMDL for the San Francisco Bay. However, because it is technically flawed and fails to comply with applicable statutory and regulatory requirements; has not undergone adequate scientific peer review; has not adequately addressed the requirements of CEQA; and constitutes an unfunded mandate in violation of State law, the Santa Clara Municipalities cannot support adoption of the TMDL in its current form at this time.

Instead, the Santa Clara Valley Municipalities respectfully request that the Regional Board direct its staff to significantly and fundamentally revise the TMDL, its implementation plan, and the associated proposed Basin Plan amendment to address the concerns delineated above and in the various comments the Santa Clara Municipalities have submitted under separate cover.

Sincerely yours,



Robert L. Falk
Legal Counsel to
Santa Clara Valley Urban Runoff
Pollution Prevention Program

Attachments

cc: Bruce Wolfe
Tom Mumley
Dorothy Dickie
SCVURPPP Management Committee
SCVURPPP Legal Steering Group
A. Olivieri

Attachment A

Declaration of Tim Mulligan,
Santa Clara County Vector Control District Manager

DECLARATION OF TIM MULLIGAN

I, Tim Mulligan, declare as follows:

1. I am currently the Santa Clara County Vector Control District Manager. I have acted in this capacity since 1995. I have over 27 years of experience working on suppression of vector borne diseases (diseases transferred from one animal or insect to humans) and issues involving public health risks from insect and animal infestations. I have a Bachelor of Science degree in Microbiology from San Jose State.

2. In my capacity as the Vector Control District Manager, I am charged with protecting the public from real and potential health risks posed by insects and animals that can transmit diseases and also work to ensure that district services resolve problems arising from insect or animal infestations, which also may pose public health risks. On account of my current and past professional experiences, I am very familiar with the potential vector production associated with stormwater detention and treatment devices.

3. I have reviewed and am familiar with Provision C.3, providing new development and redevelopment requirements, proposed by the Regional Water Quality Control Board, San Francisco Bay Region ("Regional Board") set forth in the May 18, 2001 Tentative Order amending the Santa Clara Valley Urban Runoff Pollution Prevention Program NPDES municipal storm water permit ("Tentative Order"). The Tentative Order would require municipalities to require or undertake the creation of certain types of stormwater detention and treatment devices in connection with the approval and construction of new and redevelopment projects.


4. The Tentative Order encourages and would result in the construction of detention/retention basins throughout Santa Clara County and in decreased peak flows in the county's various creeks and streams. Both results will increase the amount of standing water in Santa Clara County.

5. Standing water is prime breeding habitat for disease carrying insects, such as mosquitoes. Mosquitoes can carry various diseases, such as encephalitis and malaria, which pose a serious threat to public health. An increase in disease carrying insects increases health risks to all residents from vector-borne diseases.

6. Based on my knowledge and experience, it is my professional opinion that the Tentative Order's stormwater treatment devices present an increased risk of vector-borne disease by encouraging treatment measures that create more standing water while discouraging alternative treatment measures that do not increase standing water and thereby result in fewer vector-related problems.

I declare under penalty of perjury of the laws of the State of California that the foregoing is true and correct.

Executed this 14 day of June, 2001, at SAN JOSE, California.


TIM MULLIGAN

Attachment B

Comments of the City of San Jose on the
Regional Board's Tentative Order dated May 18, 2001

ATTACHMENT 3

Proposed Comments to the San Francisco Bay Regional Water Quality Control Board on Tentative Order dated May 18, 2001, revising provisions C.3 of Order NO. 01-024 for the Santa Clara NPDES Municipal Separate Storm Sewer System Discharge Permit (NPDES Permit No. CAS029718).

The City of San Jose objects to adoption of the Tentative Order which would impose new requirements on the City's land use and development approval process on the grounds stated in this letter and in the comments submitted under separate cover by counsel for the Santa Clara Valley Urban Runoff Pollution Prevention Program. We incorporate by reference the comments that we and Program legal counsel submitted in November 2000 concerning Board's October 13, 2000 Tentative Order, which also contained land use and development approval requirements.

Briefly, the requirements contained in the New Development provision, C.3, are not supported by the evidence in the record and exceed the Board's legal authority. Further implementation of the requirements would impose substantial costs on the City and would have adverse impacts on the production of housing, the revitalization of downtown San Jose and the local economy. In addition to these substantive objections to the proposed new requirements, we object to the proposed implementation schedule as it completely fails to recognize the often lengthy internal review, public participation, CEQA and other statutory processes that are required to make the extensive changes to City programs that are contemplated by these new performance standards. Finally, the City urges the Regional Board to work with local stakeholders in its own Watershed Management Initiative (WMI) process to set clear, objective water quality goals and allow the stakeholders to develop the appropriate technical, and locality specific approaches for adoption in a time frame consistent with the municipal administrative processes.

- 1. The Regional Board rationale for imposing SUSMP type requirements is not supported by data regarding local water quality conditions.**

The City is concerned that provision sections (C.3. b-g) require the City to specify structural storm water controls on development projects to alleviate vague or otherwise undetermined impacts on local hydrologic conditions. The City does not believe that the need for these new and redevelopment site design requirements have been adequately linked to water quality impacts in the Santa Clara Basin watershed. Unlike southern California, where there is a well-documented linkage between storm water flows and negative impacts to local beaches, impacts to waterbodies due to changes in the runoff volumes, flows or peak flows have not been adequately demonstrated or documented in the Santa Clara County permit.

The Regional Board findings [Findings 5, 6 and 7] that form the basis for several key elements of the order, declare possible impacts without adequate documentation, and prescribe control measures that have no apparent link to the impacts described. For example, Finding 5 discusses pollutants associated with vehicles and transportation, and even natural-occurring minerals from local geology and acknowledges that these *"may be derived from extraneous sources that Dischargers (municipalities) have limited or no direct jurisdiction over."* On that basis the finding declares that *"Dischargers can implement control measures, or require developers to implement control measures, to reduce entry of these pollutants into storm water."* It is unclear what relationship new development control measures have on these types of pollutants.

Finding 6 notes that "*these pollutants*" [the ones that the City has little control over] *can have damaging effects on both human health and aquatic ecosystems.*" The City does not dispute the potential harmful effects of pollutants such as atmospheric mercury, however, the causal relationship of these pollutants to the reported impacts is not established by the next statement, i.e.:

"In addition, the increased flows and volumes of stormwater discharged from new impervious surfaces resulting from new and redevelopment can significantly impact beneficial uses of aquatic ecosystems due to physical modifications of watercourses, such as bank erosion and widening of channels."

The basis for the Regional Board's findings in either item 6 or 7 does not rely on local studies or on an understanding of historic development patterns of Santa Clara County. The findings ignore the degree to which the watershed and flow regime has been altered by flood and water supply management considerations over the last fifty years. Recent evaluations of the indicators cited in Finding 7, undertaken by the Urban Runoff Program and supported by the Water Environment Research Federation (WERF), found that it was not possible to directly link urban factors such as imperviousness and storm sewer operations to influences in stream hydrology without conducting additional studies. The study concluded that other factors including dams, diversions, channel modifications, sedimentation and the episodic nature of local precipitation patterns play an important role in local stream function.

*"Interpreting imperviousness as the cause of ecosystem degradation is not defensible based on the type of analysis conducted here [calculations of percent impervious correlated to aquatic habitat metrics]; rather imperviousness may be interpreted as an indicator of areas with potential problems. Identifying the cause of such potential problems requires a much more in-depth analysis of the location and frequency with which additional factors disturb aquatic ecosystem function."*¹

The concept that higher stream flows create more scouring and erosion is not necessarily true in the Santa Clara Basin watershed with its many small creeks, many of which are concrete-lined channels and others which are protected from erosion by significant riparian banks. The City's commitment to protect these riparian corridors has, in fact, been the reason why higher flows do not cause erosion in the watershed. Finally, "accelerated erosion of downstream natural channels" is not a problem common to the lower Santa Clara Basin watershed. Here, channel aggradation is a major problem brought about by subsidence of the valley floor as a result of over-pumping of the groundwater aquifers in the 1920-30's – long before urbanization was prevalent.

For Santa Clara County, the relationship between pollutants and hydrologic effects of local storm water discharges to that of new development controls is fragile and not supported by recent studies or historical comparison of hydrologic effects. The concept that structural control measures for volume and flow placed on the relatively small portion of the urbanized area represented by new and redevelopment projects would have demonstrable effect on channel morphology, or flow regime of local streams, is not supported by the record. As constructed, Section f. could result in costly control measures that fail to address the water quality issues in

¹ See Stormwater Environmental Indicators Pilot Demonstration Project – Technical Memoranda #7 and #14 (Santa Clara Valley Urban Runoff Pollution Prevention Program, January 2001).

Santa Clara County watersheds. The prescriptive aspect of these control requirements is not technically justified by the findings. Nor can the substantial increases in public investment for public works projects and for the operation of the storm sewer system, and in private costs in the form of higher housing costs be warranted by these findings.

Where water quality problems have been clearly identified, San Jose has demonstrated a strong commitment to improving the water quality conditions and to formulating sound and feasible solutions. The City funded the development of a Total Maximum Daily Load process that characterized the copper and nickel problem in South San Francisco Bay and resulted in action plans aimed at reducing these pollutants in the storm sewer system to reduce the impacts to both streams and the Bay. Currently, the City, together with the Santa Clara Valley Water District, is supporting a similar TMDL process to address Mercury levels in the Guadalupe River and in monitoring for PCB hot spots throughout the region.

The City urges the Regional Board to work with local stakeholders using its own WMI process to complete the watershed assessments, currently underway. The assessments will enable the Board and the public to develop a common understanding of water quality conditions in local streams based on actual monitoring data. This would enable the Board to carefully craft regulatory goals and requirements that will serve to protect and maintain the unique aquatic environment of Santa Clara County streams and waterbodies.

2. The requirements imposed on Santa Clara County, including the City of San Jose, exceed the requirements previously approved by the State Board

Program legal counsel will address our legal objections to using the State Water Resources Control Board "SUSMP" Order² as a basis for adopting the Santa Clara Basin Tentative order. Here, we want to express our concern that, despite a lack of data regarding local climate, soil, groundwater and land use conditions in Santa Clara County, the Regional Board has broadened the scope of SUSMP requirements while, at the same time, imposing narrower prescriptions for compliance. Our analysis of SUSMP provisions imposed on Los Angeles and San Diego reveals that the language of this Tentative Order is far more prescriptive and contains additional provisions not contemplated by the State Water Resources Control Board order.

For example, the Los Angeles SUSMP provisions focus on large commercial projects (greater than 100,000 sq. ft.), and land use types with greater potential to generate or transport pollutants such as automotive repair shops, parking lots, gasoline stations and residential hillside developments. In the proposed provision C.3.c, the Regional Board has significantly broadened the scope of development projects subject to the requirements by reducing the size of the projects to one-acre (43,580 square feet) of combined impervious surface area, and by expanding the types of projects covered to include residential subdivisions, redevelopment projects and public streets (the "Group 1" projects). In addition, the language calls for a phasing in of "Group 2" projects, those as small as 5,000 square feet, regardless of land use type unless the City proposes a different size range that treats 80% of the new impervious surface area annually. This inclusion of a wider range of developments is not contained in the SUSMP provisions.

The Tentative Order offers no rationale for broadening the sweep of its 'SUSMP-like' provisions, for either the Group 1 or Group 2 projects. It would be more appropriate for the

² SB Order WQ 2000-11: SUSMP Issued October 5, 2000.

language to set a reasonable treatment goal and allow the municipalities to develop categories that can achieve that goal. To do otherwise squanders public and private resources and ignores existing development policies. For instance, unlike Los Angeles, San Jose Municipal Code does not allow construction of homes outside the Urban Service Area (USA) which largely deters development of homes on steep, erodable hillside sites. The City also has policies in place to control development above the 15% slope line (the SUSMP provisions are not triggered for residential development except single family hillside development on slopes greater than 15%.) The City currently requires gas stations, parking lots, wrecking yards, recyclers, and other land uses with high pollutant generating potential to treat their runoff to prevent pollutants from entering the City's storm system.

At the same time that the provision broadens its reach to include more development projects, it prescribes specific numeric hydraulic sizing criteria for storm water volume- and flow-based structural treatment measures similar to those established in the Los Angeles permit. These criteria are not based on San Jose or Santa Clara Basin climate or soil conditions, nor does the language allow localities to propose alternative criteria based on actual conditions in the basin, in a specific locality or sub-basin. It is puzzling that the Regional Board Fact sheet for the permit cites "other methods of establishing storm water treatment measures" and provides numerous examples of municipalities and states where various alternative methods have been applied as well as describing methods acceptable to USEPA. Neither the findings nor the Fact Sheet provide a rationale for the particular design criteria imposed by the permit language. In fact, the discussion supports the concept of setting clear regulatory goals and allowing localities to establish both hydraulic sizing criteria and treatment methods suitable for application to local conditions, rather than imposing specific criteria in an arbitrary manner without the obtaining appropriate local information.

In a similar fashion, the requirement set forth in Section C.3.f., *Limitations on Increase of Peak Stormwater Runoff Discharge Rates* extends beyond the SUSMP precedent. This section mandates that post-development peak stormwater discharges rates and durations not exceed pre-development levels for new and redevelopment projects. It requires that the City develop and implement a 'Hydrologic Modification Plan' complete with evaluation protocols, and management measures. These specific requirements represent new standards imposed solely on Santa Clara County permittees, for which there is no guidance or precedent.

It should be pointed out that several other elements of the recently issued 'precedent setting' permits in Los Angeles and San Diego Counties have been required of the Santa Clara County permittees since 1995 and have been implemented by the City and its co-permittees since 1996. These requirements include minimizing pollutants of concern, stenciling storm drain inlets, incorporating source control in designs for material and trash storage areas, vehicle and equipment wash areas, fueling areas at gas stations and automotive repair shops. San Jose has actively implemented Post-Construction Treatment measures for structural storm water control since its adoption of its policy in 1997. The policy targets land uses that have potential to generate pollutants including wrecking yards, automotive servicing shops, parking lots and a broad range of commercial uses. Some 60 major new developments have been required to install such control measures on their sites since that time.

In addition, the City has contributed substantial time and resources to the Regional Board-sponsored Watershed Management Initiative and over the last five years has been instrumental in supporting this approach for identifying and solving water quality and watershed management

issues using local stakeholders. The City asks the Regional Board to respect the stakeholder process it has created and allow local stakeholders to determine the manner in which it can comply with the goals set out by the provision rather than impose rigid command and control requirements that do not reflect the communities' solution to the problems identified.

The use of State Board precedent to justify the imposition of permit requirements may be a standard regulatory practice, however, the proposed provision extends beyond existing precedent in crucial areas. The Regional Board has also chosen to ignore previous direction regarding the use of the WMI stakeholder process to discuss controversial issues as part of the public participation process. This language imposes an additional burden on the City of San Jose and other co-permittees that is not warranted by its history of compliance, or by its willingness to respond to previous Regional Board initiatives. In fact, San Jose and the other municipalities in Santa Clara County have a clear record of developing innovative solutions to the regulatory goals of the stormwater permit program. On that basis, the City requests that the Regional Board consider these efforts in determining the methods of compliance for new and redevelopment projects.

3. The implementation schedule for the Enhanced New and Redevelopment Performance Standards is not achievable.

The City of San Jose is extremely concerned that compliance with elements contained in Provision C.3. New and Redevelopment Performance Standard Enhancements is not achievable. The implementation schedule requires the City to modify its development review procedures and implement new design standards, and operation and maintenance requirements in eleven months (C.3.b and e. by July 15, 2002). It further contemplates that the City repeats this process every year of the permit period to fulfill other provisions (section f. July 2003, sections k. & m. March 2003, section j. September 2004, section l. July 2005). This schedule wastes resources by forcing the City to go through a series of procedural changes that, with more time and proper scheduling, could be done all as one process as discussed below. The proposed schedule requires the City to impose little-understood engineering requirements on the community first and determine the efficacy and implications of these requirements later. This is not only unworkable, it would lead to confusion on the part of the public and City because, as result of the timing, the approval process procedures would be in a constant state of flux for the next four years. The compliance schedule shows little understanding of municipal administrative processes and negatively impacts local decision-making processes.

Effective modification of the development project approval process procedures to incorporate all of the changes contemplated by this provision requires additional time to develop the necessary technical support information, guidance, policies and, where needed, ordinances. In a municipality the size of San Jose, development of even routine, well defined and technically acceptable changes to ordinances, policies and procedures requires eighteen months to ensure adequate internal and public review prior to adoption. In this instance, the required standards are fraught with technical and procedural barriers. For this reason, it would require a minimum of thirty-six months to effectively develop the necessary ordinances, policies, procedures and stakeholder input required to incorporate the requirements set forth in sections C.3. b., d., e., g. i. and the pesticide element of n. into the City's existing new development approval process. The Table below outlines the steps and schedule needed to establish and apply the elements of hydraulic based designs and Operation and Treatment measures.

Schedule for Implementation of Procedural Changes In Development Approval Process	
Tasks/Actions	Completion Date
Adoption of Permit Requirement	8/01
• Informational staff report to Council, Departments Inventory existing design standards, criteria	11/01
• Review existing ordinances, policies and guidelines • Identify barriers to design standards • Identify elements of design standards already being implemented Develop multiple alternatives for new standards	3/02
• Compare current requirements to LA and other standards utilized elsewhere • Prepare multiple rainfall design criteria • Analyze costs and effectiveness of alternatives Develop analysis of alternatives	8/02
• Focus meeting with developers, etc. • Planning commission information report Revise alternatives based on impact	10/02
• Choose recommended alternative • Prepare documentation plus staff report • Prepare budget estimates – resources needed Finalize recommendations at staff level	12/02
• Interdepartmental review • Prepare budget documentation Forward ordinance and budget recommendation for action	2/03
• Ordinance language changes prepared by attorneys Ordinance staff report prepared	5/03
• Compare to other geographic areas • Regional board review • Developers review • All staff review Ordinance public review process	08/03
• Address public concerns • Revise as needed Ordinance to Planning Commission	10/03
• Address Planning Commission concerns • Revise as needed Ordinance to City Council	1/04
• Develop detailed implementation procedures • Train staff • Notify affected parties with outreach information Effective date of new requirements	7/04

This schedule assumes that the technical considerations can be addressed using existing hydraulic and climate information and that the treatment methods have standard specifications suitable for inclusion in plans. Inherent technical issues (discussed below) and lack of necessary data to establish hydrologic modification criteria could defer implementation of Section C.3.f. (Limitations on Peak Runoff Discharges). That provision can only be undertaken once studies are conducted and appropriate data is acquired. These studies and data should be the primary driver for the implementation schedule for the development of Hydro-modification Management Plans.

This provision also contemplates substantial changes in the City's development plan approval process, capital improvement program and operations and maintenance without regard to its management, planning, budgeting and staffing processes. For instance, next year's budget and revenue requirements will have been set by the time these requirements are being adopted. The compliance schedule does not allow the City adequate time to identify or garner the resources needed to meet these requirements. San Jose has instituted a stormwater utility to fund the current program. However, the additional workload and public project costs that are generated by these new requirements will require rate increases. Implementation of rate increases necessitate several months of advance preparation before increased fees can be considered, much less imposed on the rate-paying public. The compliance timetable ignores the realities of public program revenue generation under Proposition 218, which mandates that rates be collected in proportion to the benefit received by the ratepayer.

- 4. If the proposed provision is adopted, there are extensive adverse economic impacts on housing, infill development policies, redevelopment projects, municipal budgets and the local economy that have not been considered by the Regional Board.***

The tentative order does not provide an evaluation of the economic impacts of the requirements on the municipalities. There has been insufficient time for the City to evaluate the cost of these requirements. However, preliminary estimates of the costs of compliance are considerable and have the potential to negatively impact housing, infill development policies, redevelopment projects, municipal budgets and the local economy.

Housing and Infill Development

Under the proposed provisions, the City would essentially need to require that every development project detain/retain storm runoff on site. This approach would decrease the amount of developable land area for each project, ultimately reducing the total number of housing units or square footage of job-generating uses. The reductions in housing and jobs are direct trade-offs for a presumed water quality benefit. In other words, the City will not be able to achieve its jobs and housing goals.

For infill locations, it is just not practical to set aside land for detention/retention basins on a project-by-project basis. If approved, these Provisions would affect the design and physical layout of projects. The costs associated with these stormwater controls would inhibit infill development, reduce the production of affordable housing, and add significant costs to the construction of important City facilities (i.e., new City Hall, branch libraries, fire stations, etc.).

Since the mid-1970s, the City of San Jose has been encouraging and fostering infill development to accommodate growth while not sprawling southward or into the hillsides. For much of that time, infill development has occurred on vacant parcels that had been previously overlooked for development. Since the late 1980's, the City has been aggressively planning for the reuse of underutilized parcels, resulting in the recycling and redevelopment of land for more intensive residential, commercial, and industrial development. In addition, this approach has led to the revitalization of Downtown as well as transit-oriented development along existing and planned rail lines, contributing to a "smarter" growth pattern.

San Jose is expected to continue to grow in infill locations and to intensify land use patterns as called for in the *San Jose 2020 General Plan*, many specific plans, *Downtown Strategic Plan*,

and other planning documents. The proposed stormwater controls for detention/retention under the draft Provisions would result either in land being set aside for detention basins or in detention basins built underground. These requirements would affect the physical design and site layout of all development, resulting in unattractive detention basins all over the City. The requirements would also add tremendous costs to private infill development and to other projects of great interest to the City, such as the construction of new affordable housing and City facilities (i.e., new City Hall, branch library expansions, new fire stations, etc.).

The draft Provisions do identify a waiver process from treatment controls if they are determined to be impracticable due to limitations of space, high water table, unstable soils, or other below surface conditions. If a waiver is granted, then the developer would be required to pay a fee equivalent to the cost of the stormwater control into a fund which could then be used to address stormwater pollution in the watershed of the development. Program legal counsel's comments will address the legal deficiencies with the proposed fee for waiver provision.

In any event, the cost to development (private or public) would be significant, either effectively reducing the project's size or rendering it financially infeasible. These requirements may hinder the private sector from building in areas long planned for infill development. More importantly, the City's limited dollars for affordable housing and capital improvements would be further constrained, resulting in fewer affordable housing units or smaller City facilities. Therefore, the City would not be able to achieve its economic development, housing, or service level goals.

The Regional Board has presented no evidence that the water quality and watershed benefits of the proposed Provisions outweigh the negative effects and total costs associated with constructing the stormwater controls. Nor has the Regional Board considered the opportunity costs associated with the loss of smart, infill development, Downtown revitalization, affordable housing, and expansion of needed City facilities. The proposed Provisions unfairly penalize infill development, particularly on already developed sites, and would result in inefficient, unsightly, detention basins throughout San Jose, contrary to City policies.

Public Works Department

The proposed changes to the permit would result in more labor intensive and costly reviews in the planning stages of a project, in the grading plan review, and in construction inspection. In the planning stage, it will be necessary to review the numerical sizing calculations to certify the control measures as BMPs. In the grading plan review, drainage details and calculations would have to be reviewed. The inspection of the grading of the detention/retention facilities is more labor intensive than are the current reviews necessary for piping systems. Cost recovery fees for planning review and grading permits would need to be increased to account for the additional plan review and inspection staff that would be needed for the implementation of these new requirements. These costs will be passed on the developers, and ultimately the public increasing of costs of housing and commercial space in an already highly priced market.

All staff would have to be trained in the subject of detention and retention basin design. Although the nineteen civil engineers in the division are trained and capable of reviewing hydraulic and drainage designs, detention and retention design is a specialized subject that would require continuous specialized training.

Implementation of traffic flow improvements (street-widening projects) would be severely impacted by the application of these requirements to new streets. The average public residential street covers 4.36 acres per mile, therefore even minimal widening and expansion projects encompassing one quarter mile could be subject the provision. The costs to install control measures to mitigate street runoff volume would be substantial even where there is sufficient vacant land area to do so. In most cases where traffic flow improvements are needed there is little right-of-way available for such structures and in those areas the cost to incorporate volume and/or flow controls would render the project infeasible.

Construction of the required structural control measures on new public facility sites will have a significant impact on the City's Capital Improvement Program and would have the effect of reducing the availability of funds for other projects including critical storm sewer collection system rehabilitation.

Department of Transportation

DOT would have the primary responsibility for Operations and Maintenance on public and, possibly, some privately constructed facilities. This could have significant resource implications which might require resolution of the Special Assessment District funding as these costs would have to be incorporated in the Storm Sewer Charge Fee.

DOT currently reviews all public storm facility construction plans. The new provision would increase the review period because additional time would be needed to ensure that structural controls are designed to optimize Operations and Maintenance efficiency as well as report on the outcomes. This new level of effort is currently not funded and would require at least one full time engineering staff at a cost of approximately \$80,000/year to conduct plan reviews and fulfill the reporting requirements.

DOT currently maintains five regional debris/detention basins. Maintenance of these facilities consists of removal of sediment once to twice per year at a cost of approximately \$39,000 per location per year. Structural control facilities designed to treat volume would presumably require more specific types of maintenance particularly if landscaping were a key element of the treatment. The estimated cost to maintain the facilities mandated by this provision is estimated at up to \$50,000 per location per year.

Planning, Building and Code Enforcement

Compliance with the proposed Provisions would add to the workload of the Plan Implementation Division Staff. The proposed Provisions have the greatest impact on the Plan Implementation Division in terms modifying the development review process (described above) and implementing the Provisions. In particular, the implementation of the Provisions would involve working closely with applicants to resolve project design issues associated with the Provisions and assuring compliance with the Provisions. Due to these provisions, extended processing times are expected for all applications and would necessitate the addition of one Planner II position (\$80,000 per year) to keep processing times within reason.

Compliance with the proposed Provisions will add to the workload of Building Division staff. Plan Checkers, would need to verify that the Public Works approved civil engineering and grading plans are included in the building plan set. The civil engineering and grading plans would document the stormwater controls.

For certain stormwater controls, such as inlet filters or Jensen interceptors, the Building Division may need to review hydraulic calculations at the time of plumbing permit issuance.

Compliance with the proposed Provisions will affect the workload of Code Enforcement staff and may require additional staff resources to complete proactive, random inspections of stormwater controls. Code Enforcement's role would consist primarily of enforcing development permit conditions, which would include the operation and maintenance of stormwater controls. While the enforcement of permit conditions is one of several existing responsibilities for Code Enforcement Inspectors, it is currently performed only on a complaint basis. The proposed Provisions would require a more proactive approach to randomly inspect a sample of projects every year to determine compliance with the permit conditions associated with the operation and maintenance of the stormwater controls. Code Inspector(s) would need to be trained to understand various stormwater controls and be able to evaluate their performance. The information collected by the Inspector(s) would need to be documented and provided to the Urban Runoff Planner in the Planning Services Division for inclusion in the Annual Report to the Regional Board. It is estimated that compliance with this Provision would require 0.5 FTE of a Code Enforcement Inspector II (\$38,000 per year).

5. Additional evaluation is required to ensure that the enhanced Control Measures are economically and technically feasible.

As there was not enough information to establish a sound technical link between water quality conditions and the need for these particular control measures, there is a need for additional evaluation of whether technically appropriate measures are "practicable" (technically feasible, cost-effective and consistent with other City policies and mandates) for the City to implement. This information is absolutely critical to the process of developing effective standards, policies, and procedures for incorporating control measure requirements into the project approval process.

A majority of the control measures to be considered by developers involve setting aside portions of a site for detention basins, vegetated swales, or infiltration devices. However, the high clay content of local soils and low percolation capacity could make infiltration infeasible for many areas in the Santa Clara Basin. Local conditions could necessitate larger retention basins on sites to allow for evaporation of runoff. This means a larger portion of the site would have to be

dedicated to treatment and less area would be available for development. This creates a twofold economic impact in that there is the loss of the value of the land dedicated to treatment and an opportunity cost associated with the loss of development potential. Preliminary estimates from Public Works indicate that the likely impact of these measures on a project may be around 10 % of the project cost.

These cost considerations strike heavier on infill and other non-suburban projects and the economics of constructing these structures may result in unintended consequences to the environment. For example, the requirements appear to conflict with current City policies to promote infill and affordable housing projects, and increase densities along transit corridors. These requirements may be difficult to incorporate into these types of sites and could result in pushing development onto lands that have no previous development.

For example, the City's Redevelopment Agency (RDA) estimates that construction on both large office and other infill projects could be halted by these requirements, as there is not sufficient land to accommodate the buildings and retention systems. These projects include:

- Boston Properties, Almaden Boulevard - 800,000 sq. ft.
- Adobe Phase II - 200,000 sq. ft.
- Riverpark Tower II - 300,000 sq. ft.
- Block 2 Tower - 300,000, sq. ft.
- Legacy on Julian Street - 1,000,000 sq. ft.
- Palladium Mixed Use - 3,000,000 sq. ft. (of which a significant portion will be housing mixed with retail; or hotel)
- Convention Center expansion - 500,000 sq. ft. (or more or less)

Where redevelopment replaces surface parking lots water quality is actually improved without the additional burden of detention/retention/infiltration. By eliminating a direct source of automobile pollution into the storm drain (asphalt oils, motor oil, brake fluid, radiator fluid, brake dust, and other toxics mobilized from the paved surface by stormwater), and replacing it with a structure that has controlled drainage, covered vehicles, and the ability to control automobile waste by containing it within the building as well as by being required to connect the interior drains to the sanitary system, the pollutant loads will be reduced and runoff volume will be decreased. The connection of washdown and other interior garage drains to the sanitary system in essence creates a combined sewer system for these projects, which is hugely beneficial to the goals of the Board.

The Redevelopment Agency and the Housing Department are under Council (and public) directive to create in excess of 1,000 housing units in and around the downtown each year for the next five years. These are all infill projects, many in existing residential neighborhoods that would consolidate small parcels into development size sites.

The addition of an exaction or mitigation fee to pay for the hypothetical cost of a retention system would make these difficult projects even more economically infeasible than they already are in a marginal and struggling environment. The redevelopment of economically underutilized and under valued properties into economically productive land would be severely hindered by the implementation of these rules.

Housing, especially affordable housing, is difficult to construct in the downtown. To add costs to these projects could render them infeasible, shifting development to the outlying areas, i.e., the

undeveloped areas of the city and county, away from transit opportunities and continuing the pattern of sprawl.

In the absence of local stakeholder involvement in developing these provisions, the Regional Board has neglected to evaluate the impacts of these requirements on local housing supplies. The City suggests that these impacts are vast and require additional evaluation prior to imposition of these requirements on the municipalities in this County where the shortage of housing is indisputably one of the most severe in the region, if not the state.

6. Additional study and time is needed to establish the technical bases for the structural controls.

These requirements and timeframe essentially mandate a 'piecemeal' project by project approach to managing storm water flow. The haste to impose these requirements essentially drives the construction of hundreds of detention/retention facilities scattered within a watershed. This is contrary to accepted engineering practices that recommend regional facilities as more efficient and cost effective from a maintenance and operations perspective. Many widely scattered detention basins are more costly and inefficient and will increase the resources needed to respond to emergency maintenance on both public and private facilities during storm events.

Staff has found that more "regional" solutions achieve stronger water quality and hydrologic benefits than individual project-by-project solutions. Regional solutions have been incorporated into the planning and zoning of several large development areas. For example, a retention basin could serve all 50,000 jobs in North Coyote Valley, basin(s) on Communications Hill could support the development of the planned 4,000 units, and basins in Edenvale would facilitate significant job generating uses.

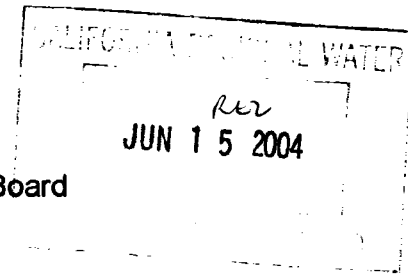
Finally, there are significant vector control consequences, particularly mosquitoes, associated with detention basins and other treatment devices. The water quality benefit of these treatments needs to be evaluated against the potential to impact public health.

It would be nearly impossible for the City to gather the information necessary to fully consider the implications of these requirements and to determine whether there are additional practicable control measures by the proposed compliance dates for these provisions. The compliance dates do not allow adequate time to evaluate the optimum approaches to these programs, to involve the affected publics, or to conduct administrative processes associated with crafting feasible policies and ordinances.



June 14, 2004

Mr. Richard Looker
California Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street 1400
Oakland, CA 94612



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Subject: Mercury in San Francisco Bay: Total Maximum Daily Load
(TMDL) Proposed Basin Plan Amendment and Staff Report,
April 30, 2004

Dear Mr. Wolfe:

We have reviewed subject report and wish to offer our comments as follows:

1. The proposed Mercury waste load allocation for municipal dischargers as a group is reduced to 14 kg/yr in the April 2004 Report from 17 kg/yr in the June 2003 Report, representing a 17% reduction. Similarly, the allocation for Mt. View Sanitary District is reduced to 0.024 kg/yr in the 2004 Report from 0.060 kg/yr in the 2003 Report representing a 60% reduction. This reduction will cause a serious compliance problem for our district, especially in the wet years, because of increased waste water flows. Because municipal wastewater dischargers, as a group, currently contribute only 1.3% of total mercury loading to the Bay, further reduction for municipal dischargers' waste load allocation from what was proposed in 2003 will contribute little to the overall load reduction needed to meet the proposed waste load reduction targets. We suggest that you consider restoring the proposed allocation for municipal dischargers to 17 kg/yr and Mt. View Sanitary District's allocation to 0.06 kg/yr as was proposed in the 2003 Report.

2. The 2004 Report proposes to evaluate waste load compliance for municipal dischargers as a group annually. We recommend the compliance be evaluated every five years using five-year averages. This will address our concern of higher waste loading from our and other municipal wastewater treatment plants due to higher loading caused by high flows during wet years.

3. We would like to have an opportunity to work with your staff either through Bay Area Clean Water Agencies or individually to resolve our concern.

Thank you very much for the opportunity to comment on the proposed Mercury TMDL and Waste Load Allocations.

MT. VIEW SANITARY DISTRICT
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MARTINEZ, CA 94553
925-228-5635
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Sincerely,

David R. Contreras

David Contreras
District Manager
MT. View Sanitary District

cc: Bill Johnson - RWQCB
Richard Looker - RWQCB
Robert Schlipf - RWQCB